DISCOVERY

A MONTHLY POPULAR JOURNAL OF KNOWLEDGE

Edited by EDWARD LIVEING, B.A.
Scientific Adviser: A. S. RUSSELL, D.Sc.

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JANUARY TO DECEMBER
1923

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JOHN MURRAY, ALBEMARLE STREET, W.

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SCIENTIFIC ADVISER: A. S. RUSSELL, D.Sc.

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NEW ELECTRIC LOCOMOTIVE FOR THE RHÆTIAN RAILWAY, SWITZERLAND
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JOHN MURRAY, 50A ALBEMARLE STREET, LONDON, W.1.

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DISCOVERY. A Monthly Popular Journal of Knowledge.

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Editorial Notes

WITH this number DISCOVERY enters the fourth year of its existence. During the last year many advances were made in all branches of the Arts and Sciences. With those advances it has endeavoured to deal in articles that have avoided, as far as was possible, the technical language in use in each branch without at the same time losing sight of the necessity for an accurate and truthful interpretation of the results obtained by the careful research worker. To mention only a few articles, our journal has kept abreast of the steadily increasing use of wireless telegraphy, the new researches into the nature of radio-active elements, recent developments in aeronautics, the economic difficulties which have harassed Europe and our own country during 1922, the brave second attempt to climb Mount Everest, some intensely interesting archæological discoveries in Egypt and Greece, the attempts to solve a variety of physiological problems, and some striking new theories put forward by the psychologist.

* * * * *

In our columns Professor Flinders Petrie has described the method he has been employing in Upper Egypt to reduce to historic order "what is usually called the Prehistoric Age"; Professor Alfred Wegener has given the first description in English of his new theory of the origin of continents and oceans; Mr. Julian Huxley has outlined his researches into the problem of sex and its determination; and Professor Zammit has written about his excavations at Malta of some remarkable monuments belonging to the later Stone Age. Again, the meeting of the British Association at Hull this year brought many new problems and attempted solutions thereto before the public, including M. Coué's theory of auto-suggestion, and a problem which is at present receiving a great deal of attention from anthropologists, namely the study of the mental characteristics peculiar to different races. Here again we have endeavoured to supply our readers with careful accounts of what our famous scientists and intellectuals are thinking and doing to-day.

* * * * *

A question which is receiving steadily growing attention at the hands of both the psychologist and the physiologist is the relationship between body and mind. At present the results obtained cannot be considered as anything but indefinite. In this direction a fuller co-operation between these two lines of study is necessary. It must be quite obvious to all educated men and women that in this field of knowledge science is destined to play a very important part in the life of the community, for in touching upon the basis of human personality it cannot fail to be reflected in what is still one of the most important backgrounds of all human life and action, namely religion. How deeply this problem is being discussed by everyone who ever gives a thought to the question of why he is existing upon this planet was illustrated in a most interesting way by the large quantity of correspondence which reached this journal as the result of a discussion in the *Editorial Notes* last April concerning an American book published a few months previously on the subject of the influence of the ductless glands on personality.

* * * * *

This correspondence showed us very clearly how, apart from the object of placing new or attempted discoveries before our readers, we need to find out from them what influences such discoveries are creating in the individual's life and thought, and his attitude to these new conceptions. In many trials the expert, be he a doctor or a specialist in finger marks, is consulted, but the laymen in the shape of the jurymen

give the verdict. Every respect and honour must be given to our contemporary pioneers of knowledge, but we feel that encouragement cannot fail to assist them. The finest form of encouragement is the interest shown by our thinking public. It is to promote that interest, and to ascertain into what channels that interest runs, for which DISCOVERY stands. Our readers will be doing a service to themselves, their journal, and the cause of intellectual progress if they will inform us of the special subjects which interest them and, generally, of their ideas and wishes concerning the conduct of DISCOVERY.

* * * * *

There were some very sharp criticisms expressed in England a few months ago when a report was received that a new German drug for the cure of sleeping-sickness would be kept secret in the interest of German colonial schemes. We heard it said that this was a typical example of German ways of thinking—an unkind comment on the land that gave us Koch's treatment of tuberculosis, to mention only one of its services to medicine. Our national sense of superiority must have received a shock recently to learn that the production of "Insulin," a substance used in the treatment of diabetes, was to be controlled. There was some hint of the same spirit in the suppression of formulæ for a lead compound which is being tested in cancer by workers in Liverpool. We need not say that there is no suggestion that in either case were the motives of the investigators other than creditable. The fact remains, however, that we must face a new attitude towards scientific remedies for disease. Their usefulness is to be examined by a minority; their development, if it comes at all, must come from a small group of experimenters.

* * * * *

It is argued that a misapplication of a valuable agent for the relief of disease may lead to its discredit. This, of course, is a different motive for secrecy or control than that which inspired the commercial exploitation of the first forceps employed in child-birth. But is it a fact that a really valuable invention loses anything by the widest possible investigation and development? We owe a great deal to the large English manufacturing chemists for their modifications of such drugs as thyroid gland, quinine, and chloroform. The wish to restrict investigations to a selected body of men is in truth a form of egotism. Not even the most eminent scientist is the seat of all learning; even if he were, he could not hope that all the fortunate accidents which often bring success would happen to him and to him only. The freemasonry of science is its great glory and its great advantage in the search after truth, and any tendencies to a narrowing of the fields of research are unwelcome.

The First World Flight Attempt

By Major W. T. Blake

[The first attempt to fly round the world was organised by Major W. T. Blake last year. The three participants in the flight were the author, Captain N. Macmillan, and Mr. G. Malins. In this article Major W. T. Blake gives his first complete description of the flight to appear in an English magazine.—ED.]

AT 3.7 p.m. on 24th May last year we left Croydon Aerodrome, subsequently reaching Paris and Lyons, whence we intended crossing the Alps. On reaching Chambéry we found the whole mountains shrouded in mist, making the passage too risky to attempt. I therefore passed a note to Macmillan, who was piloting the machine, to proceed due south for Avignon and Nice. Shortly afterwards our trouble began. When over Aix-en-Provence the engine began to run extremely badly, and it became necessary to land as soon as possible.

A FORCED LANDING AT A RACE-MEETING

At Lyons we had been told that there was an aerodrome at Marseilles, and we therefore headed for this city. We arrived over Marseilles to find it situated in the midst of country, with hills, boulders, and ravines, with no single space in which it would have been possible to land a machine for miles around. In the city itself the only possible place was a small race-course, surrounded by trees and houses, and more than half covered by what we afterwards discovered to be stands erected for a gymnastic display. A race-meeting was in progress.

After flying low over the course to inspect it thoroughly, Macmillan turned in, threw the machine into a vertical side-slip, coming over the stands, flattening out at the last possible moment and nearly bringing off the landing. Unfortunately there was a ditch across the only open part of the race-course. This caught the left wheel of the under-carriage, crumpling it up and throwing the machine on to her nose, the tail shot into the air and I was jerked violently forward in my seat. For a moment the machine stood almost vertical on her nose, undecided whether to turn right over or to fall back. Then she fell back on to her tail skid. The only damage was to the under-carriage, a broken propeller and a broken wing skid.

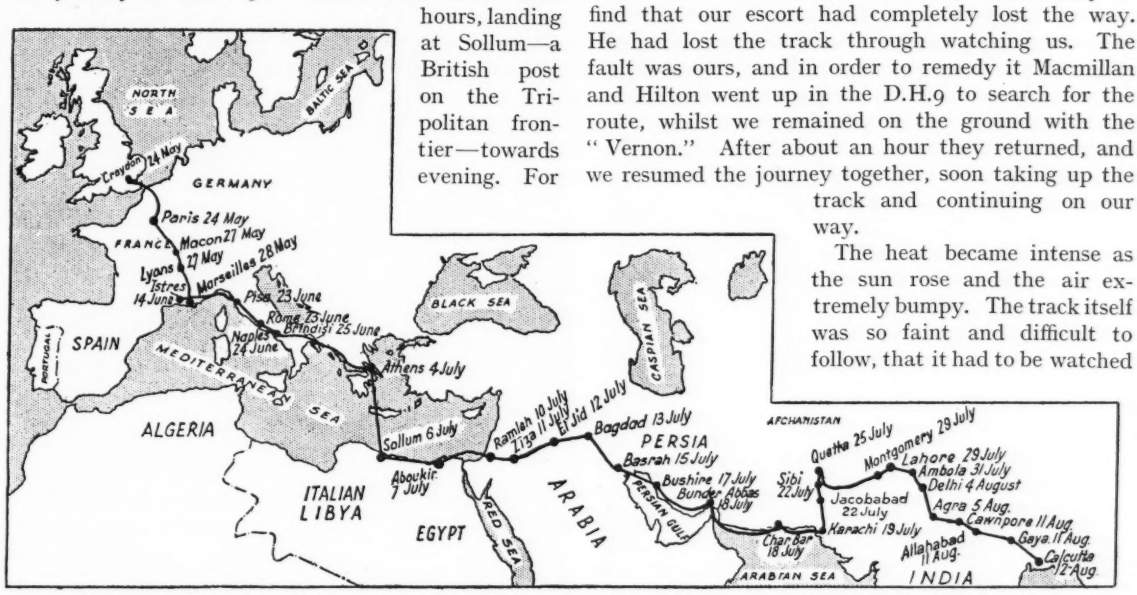
Our repairs here, owing to our having to dismantle the machine, occupied three weeks, but on 23rd June we took off once more and flew to Pisa, Rome, Naples, Brindisi, and across the Adriatic to Athens.

ABOVE VESUVIUS

As Vesuvius was in a mild state of eruption, we

took the opportunity of flying over the volcano in order to see what it looked like from the air. Little could be seen except volumes of sulphurous smoke and steam, with a red glow in its heart. The sides of the volcano were seamed with lava streams. As we flew straight into the clouds, we were bumped and rocked violently from side to side and shot about 600 feet into the air. The taste of sulphur, which is stated by scientists not to be present in Vesuvius, remained in our mouths for days afterwards.

Our crossing of the Mediterranean from Athens was entirely uneventful. The engine—a 240 h.p. Siddeley Puma—ran perfectly throughout. We accomplished the journey of about 500 miles in four and a half hours, landing at Sollum—a British post on the Tripolitan frontier—towards evening. For three hours of our flight we were out of sight of land and saw no sign of any vessel, so that, had we come down in the sea, we should not have been picked up again.



SKETCH MAP SHOWING THE ROUTE FOLLOWED BY MAJOR BLAKE ON HIS ATTEMPTED WORLD FLIGHT.

Next day we continued our journey to Aboukir, near Alexandria, and from thence to Ramleh and Ziza on the western edge of the Arabian Desert, where we were to pick up a R.A.F. machine which was to escort us across the desert.

The desert crossing is not made by taking a compass course as most people would imagine, but by following the track of motor-cars which were run across from Amman to Ramadie some time ago. All aircraft have to hold closely to this route, so that, in the event of a forced landing, machines can be sent out from either end, and by following the track cannot fail to find the stranded pilot. Landing grounds are marked at intervals across the desert.

A Descent in the Arabian Desert

The first incident of the day was when we lost the way. In order to get good kinematograph pictures of our escort—a Vickers "Vernon"—we had edged too near to her. Flight-Lieut. Hilton, the pilot, naturally wondered what we were doing, as there was plenty of room in the desert, and so had to keep a careful eye on our manœuvres in order to obviate the risk of a collision. We were flying rather low, less than 1,000 ft. above the ground, and suddenly, to our surprise, the "Vernon" throttled down and landed on a mud flat. We followed suit, only to find that our escort had completely lost the way. He had lost the track through watching us. The fault was ours, and in order to remedy it Macmillan and Hilton went up in the D.H.9 to search for the route, whilst we remained on the ground with the "Vernon." After about an hour they returned, and we resumed the journey together, soon taking up the track and continuing on our way.

The heat became intense as the sun rose and the air extremely bumpy. The track itself was so faint and difficult to follow, that it had to be watched intently, for which reason it was impossible to rise high into the air to avoid the bumps, for we could not see the trail at anything above a thousand feet.

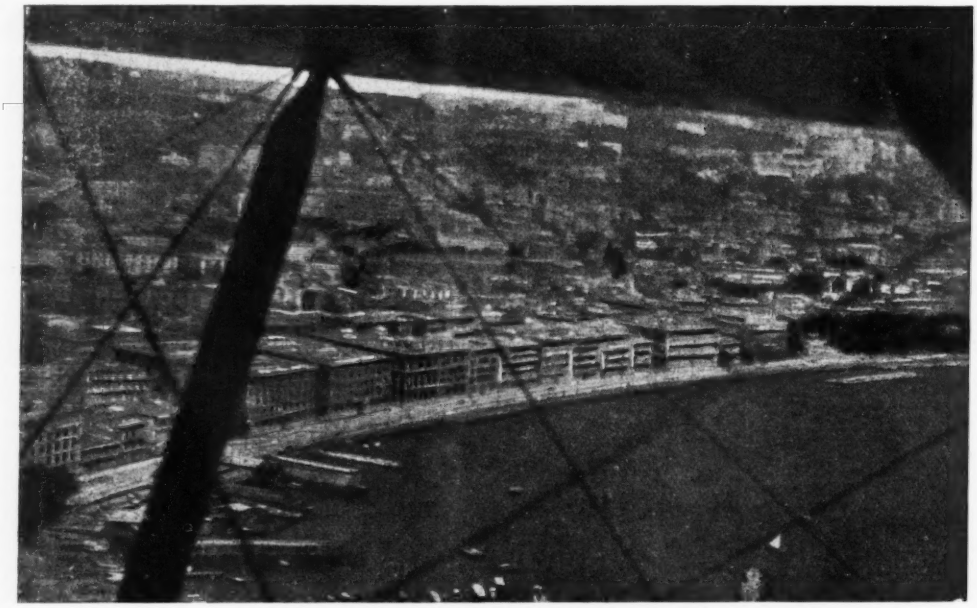
After about another hour and a half's flying the "Vernon" again landed, and once more we followed suit. This time our escort had developed engine trouble. Throughout the day work was done on the "Vernon's" engines, and towards evening Hilton tried to make another start, but the engine was still out of order, and eventually we set out alone, hoping to cover more than half the distance to Baghdad before nightfall and resume our journey early in the morning.

An Oasis and Some Friendly Arabs

Realising that water was running short through

our various delays and that there was only one well between Ziza and Ramadie, we determined to land at El Jid, a tiny oasis in the desert, in order to replenish our bottles. We came down somewhere near the well, and, leaving Macmillan to look after the machine, Malins and I started off with our water-bottles. We had only gone a few hundred yards when Arabs came up to us. They were armed and savage in aspect, but the sheikh and his sons threw their arms round our necks and kissed us on both cheeks, talking voluble Arabic, which was incomprehensible to either of us. At last, getting more and more excited in his efforts to make us understand, the sheikh drew his hand across his throat, at the same time making suggestive noises and pointing in the distance. For a moment I wondered what was about to happen, and then it dawned on me that he was referring to the killing of a sheep—a well-known Arab custom. Fortunately I found a Bedouin who could speak the Egyptian Arabic, of which I knew a little. He told us that the sheikh's children had seen us coming, whereupon the head of the tribe had given orders for a feast to be prepared in our honour, for he was very well disposed towards all flying men, since they had once helped him in great trouble.

Being anxious to push on, I declined the feast, but he was not to be outdone, and the newly killed sheep, flayed and dripping with blood, was brought along to us and thrust into the machine. Next, a skin of curdled goat's milk was produced, and of this we had to drink cup after cup. Finally, in order to pay me a great compliment, the sheikh thrust a dirty hand down into the skin and produced a handful of curds, which he squeezed into a ball and pushed into my mouth as a mark of great favour. This was the climax. All of us were making heroic efforts not to be sick. We distributed chocolates, cigarettes, and handfuls of foreign coins, then climbed into the machine and vanished into the night, for by then it was already growing dark.



NAPLES, PHOTOGRAPHED FROM THE D.H.9.

Luckily this part of the desert is all fit for landing on, and in about twenty minutes' time we came down once more. Our first act was to be violently sick, after which we rushed to the locker for our whisky bottle, only to find that it was missing, having obviously been stolen at one of our previous stopping places.

We spent a miserable night in the desert. Our only food was Bovril spread on hard biscuits similar to those supplied to dogs, but which are considered good desert rations for the Royal Air Force. On their being broken, maggots and beetles dropped out. Our water supply was very low and so hot as to be almost undrinkable. Macmillan and I lay down on the desert under the tailplane, having first dug holes for our hips, for the surface was hard and stony. Malins spread himself out in the cockpit of the machine and tried to sleep in that manner.

Owing to our numerous halts and detours, our petrol began to give out, and next day, when some

twenty odd miles from Ramadie, we landed to see if there was enough spirit to carry us there. Not one of the five tanks contained more than a few pints of petrol, but, by draining each of them and pouring the contents into one of the gravity tanks, we just managed to scrape up enough to get to the aerodrome in time to find two R.A.F. machines about to start in search of us.

Spiralling "Dust Devils"

After two days' rest, we set out for Basra on 15th July, accompanied by a D.H.9a, piloted by Flying-Officer Hewson, of the Royal Air Force. It was an extremely bumpy flight, with spiralling "dust devils" rising to a height of over 7,000 ft.

We passed safely down the Persian Gulf, and on 19th July met with a splendid reception at Karachi, our first landing in India, where we were presented with an address in a silver casket and a wonderful Persian carpet. Our appearance must have been remarkable, for we had not shaved for several days and were burnt almost black by constant exposure to the sun and wind. I was attired only in a shirt, with no collar, sleeves cut off at the shoulders, open to the waist, shorts coming halfway to my knees, no stockings, and slippers.

On landing at Jacobabad we found that it was simply an emergency landing ground with no petrol supplies. We continued to Sibi, and there found a rather similar state of affairs. Engine trouble set in, and, after communication with Quetta, we decided to go on to that station to have the engine set right and make arrangements for the necessary petrol with which to proceed to Lahore.

We then loaded up again and continued to Lahore and Amballa. Here our troubles started again. We tried several times to leave Amballa, but each time were forced to return with a failing engine. The climate had caused the rubber petrol connections to rot, and pieces of rubber were blocking the petrol pipes and choking the carburettors. Time after time we flushed out the pipes and cleaned the tanks, and though we fitted new connections the trouble continued.

We left Amballa on the 4th August, but when a few miles past Delhi, where we had not intended to land, the engine again cut out, and we were forced to descend in a ploughed field. Again Macmillan brought off an excellent landing without damaging the machine in any way, but we found that in order to get off we should have to move the aeroplane to a road some three-quarters of a mile away, over ditches, through hedges, and over a railway. Hundreds of

PREPARING TO LEAVE QUETTA.

Across India

It was our intention after leaving Karachi to cross India via Nasirabad, Delhi, and Allahabad, but whilst at Karachi we were told by the headquarters of the Air Force at Amballa that we should proceed not to Delhi, but to Amballa via Multan and Lahore. When we were on the point of departure a message came through to say that the River Indus had burst its banks and the aerodromes en route to Lahore were under water. We were therefore advised to proceed via Jacobabad or Sibi.

Indians were lent us by the Public Works Department, and these began to fill in ditches, cut through banks, and chop down trees, whilst helping us to haul the machine across the country. Before we had finished night fell and a terrible thunderstorm blew up. Rain fell in solid sheets, thunder crashed continuously overhead, and the flashes of lightning were so vivid and frequent that we were enabled to carry on our work by this light. Soaked to the skin and wading about in a sea of mud, all our helpers worked with a will, so that we succeeded in getting the aeroplane on to the road before we turned in for the night.

Flying Through a Monsoon Storm

Before we reached Agra we ran into another of the terrifically dense monsoon rain-storms. Afterwards we found that five inches of rain fell in a few hours. Our engine again developed trouble, and we landed before it actually "cut out." The propeller fabric had been stripped off by the rain, and lumps of wood were eaten out of the edges of the propeller. On inspection it was found that it was hopeless to try to continue with the engine as she was, and for a time I was somewhat at a loss as to how to proceed.

Fortune favoured us this time. I was told that the Maharajah of Bharatpur, who lived some thirty miles away, had a number of aeroplanes of exactly the same type as that which we were using. He lent us an engine, and his mechanics installed it.

At Agra, which we had reached on 5th August, I was overtaken by illness and was carried to hospital suffering from appendicitis, but despite the advice of the authorities, I decided to push on to Calcutta and prepare things for the next stage of our journey. Shortly after my arrival Macmillan and Malins arrived, having made the journey from Agra via Cawnpore, Allahabad, and Gaya in two days. This was the end of the first stage of our flight. We had covered over 10,000 miles by air, and had flown over some extremely bad country under the worst possible conditions. Among other things, we had flown the Mediterranean from Athens to Sollum on a land machine—a feat never previously attempted—and we had crossed India during the worst part of the heaviest monsoon in living memory—a thing said to be impossible.

The Final Disaster

Whilst I was in hospital recovering from my operation, Macmillan and Malins left on our second machine, the Fairey seaplane, bound for Rangoon. An airlock forced them to descend in the Bay of Bengal, and they floated about for two days and three nights before they were rescued on 24th August by Lieut.-Commander Cumming, who had been sent out from Chittagong to search for them. Their experiences were terrible. It was only due to the fact that clouds obscured the sky and rain fell most of the time that they got through alive, but had the rescuing tug arrived half an hour later it would have been too late, for the machine broke to pieces almost as they left it.

Though we did not succeed in our object, we gained a great deal of experience in flying over this part of the world, and hope that next year, if all goes well, we shall be able to carry out what we attempted.

Pencil Pigments in Writing [1]

By C. Ainsworth Mitchell, M.A., F.I.C.

The examination of pencil pigments in writing has not until recently attracted the attention that has been paid to inks, doubtless because it was regarded as unpromising. Actually much less can be deduced from pencil than from ink marks, but such facts as emerge are not without interest.

Schönemann mentions, in a curious book of his published at Leipzig in 1818, that codices of the eighth and ninth centuries contained vertical parallel markings made with a stylus, whilst from the eleventh century onwards these lines were ruled in black lead. Now graphite (black lead) was not discovered, or at least used as a pigment, until 1566, so that apparently Schönemann must have mistaken markings in metallic lead for graphite.

The microscopical appearance of lead and its alloys is quite distinct from that of graphite, the lines showing a disconnected series of patches irregularly distributed and uniformly and brilliantly lit up, and each patch is marked with regular vertical striations. This is shown in Fig. 1.

I called attention to this apparent anachronism in Schönemann's observations in a communication to *Nature* (1920, **105**, p. 12), and this drew from Professor Flinders Petrie a reply that he could give me a portion of a fragment of graphite which he had discovered in a tomb at Ghorub, in Egypt, and which must have dated back to a period between 1500 and 1200 B.C. This specimen of graphite, for which I am indebted to the kindness of Professor Flinders Petrie, is decidedly impure, containing only 39·4 per cent. of carbon, and a very high proportion of siliceous impurities. Its full analysis was recently brought before a meeting of the Society of Public Analysts (see *The Analyst*, 1922, **47**, September).

In view of this discovery of the existence of the mineral centuries before graphite was reputed to be known, I decided to examine early MSS. in this country, and I have to thank Bodley's librarian and Dr. Craster for giving me facilities to study similar specimens of pencil markings in the Bodleian Library. The results of my examination, which are recorded

[1] An article by the same author on *Ink Pigments in Writing* appeared in Discovery for last December. In connection with this article it is interesting to note that in the £640,000 will suit, settled on November 14 last year, Captain W. E. Foster and others successfully contended that pencilled alterations of certain documents were legal testamentary depositions.—Ed.

in a further communication to *Nature* (1922, **109**, 516), confirm the *a priori* conclusions upon the observations of Schönemann. In several MSS. of the thirteenth and fourteenth centuries ruled lines similar to those described by Schönemann are present, and in each case they are in a pigment of metallic lead or other metal. All the early pencil writing in annotations in books in the Bodleian is in a pigment of metal. Notable instances of such writing are to be found in the horn notebook of Casaubon (1613) and in the diaries of Anthony Wood (1676–85).

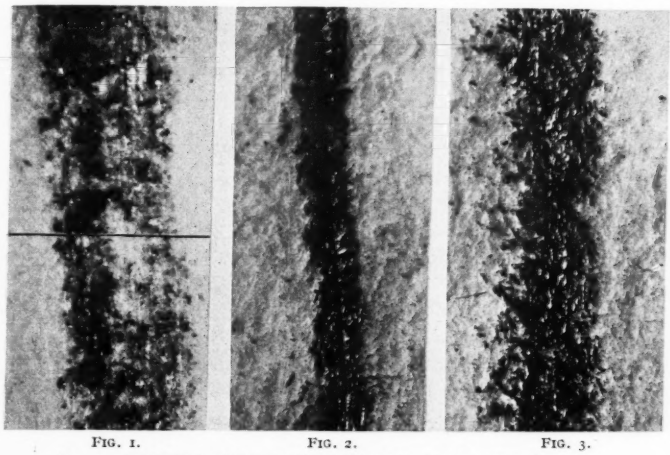


FIG. 1. FIG. 2. FIG. 3.

FIG. 1.—MARKING MADE WITH METALLIC LEAD. Magnification 20.

FIG. 2.—MARKING MADE WITH LEAD PENCIL CONTAINING BORROWDALE GRAPHITE. Period 1831. Magnification 20.

FIG. 3.—MARKING MADE WITH PENCIL OF COMPRESSED GRAPHITE. Period 1843. Magnification 20.

Pencils of natural graphite, made by cutting the mineral into strips which were fixed in a wooden holder, produce lines which show masses of brown or black pigment, whilst in heavier strokes the fibres of the paper are lit up by the adhering particles. Occasionally particles of siliceous impurities will occur, and will produce irregular disjointed striations appearing white on the dark background of the pigment, as shown in Fig. 2.

The first occurrence noted of writing in a graphite pencil in the Bodleian Library is in a note made by Anthony Wood in *A Collection of Poems on Affairs of State* (1688). The masses of pigment are quite uniformly distributed and none of them shows the lustre or striations of the particles left by lead or other metals. The earliest instances of graphite writing discovered in the British Museum were in two notebooks of Sir Thomas Cotton, one of about 1630 to 1640, and the other 1640 to 1644. Other interesting examples in the British Museum are to be found in Hogarth's notebook, the pencil marks in which are particularly free from any siliceous striations, and in Flaxman's drawings of the early nineteenth century, which are in an exceedingly fine type of graphite.

The gradual failure of the Borrowdale graphite mines led to the adoption of various substitutes. In the first place, graphite dust was compressed into solid blocks, which were then cut up like the original mineral. Pencils made from such compressed graphite produced markings which can be readily distinguished from the natural graphite. The lines show a regularly distributed series of high lights quite different from the lighter striations due to siliceous impurities in graphite, and apparently due to distribution of pigment on the fibres of the paper.

Subsequently the process of making pencils invented in 1795 by Conté, of Paris, came into general use, and by about 1870 had practically displaced the older method.

In the modern method of pencil-making, finely powdered purified graphite is mixed with China clay in proportions varying with the hardness of the pigment required, and the mass kneaded into a paste, which is forced through small openings in a cylinder so as to produce circular threads of pigment. These are dried, heated in a covered crucible, and glued into grooves in a wooden holder. In some processes wax is forced into the finished pigment by means of pressure.

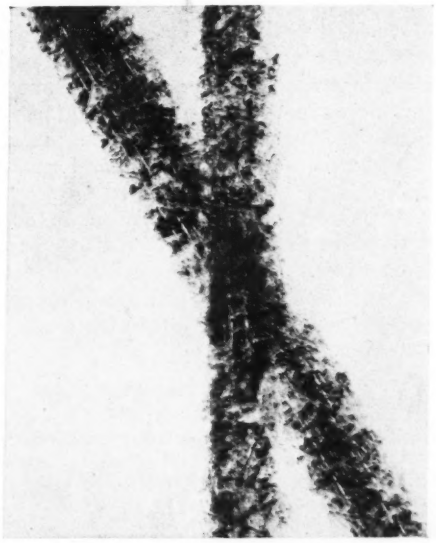


FIG. 4.—LINES MADE WITH A MODERN CHEAP COMPOSITE PENCIL.

The striations indicate the sequence of strokes. Magnification 20.

The microscopical appearance of the lines made by

these composite pencils is quite characteristic, for the particles of clay, regularly distributed throughout the mass, appear as fine silvery striations, somewhat resembling minute strings of pearls, running in fine parallel lines from end to end of the stroke.

In view of the fact that this process of making composite pencils was invented in Paris, it is interesting to note that a card written to Flaxman by the French painter Epinat, between 1805 and 1814, shows the distinctive silver striations of modern pencil pigments. This is the first occurrence noted of such markings in the MSS. Department of the British Museum.

Since the pigment after its application to paper does not undergo any appreciable alteration, it is not possible to form any estimate of the age of pencil writing by methods similar to those applicable to ink in writing. There is only one possibility upon which such a judgment may sometimes be based. If at any point two lines written with lead pencil intersect, it is usually manifest which line is uppermost, for the silver striations in that line will run without interruption from end to end, whereas those in the lower line will be broken at the point of intersection (see Fig. 4 above). Under these conditions it is possible to state which of the two lines was made first.

Apart from microscopical differences in the form and appearance of the silver striations, writing in different pencil pigments may sometimes be differentiated by chemical tests. For example, the graphite and clay used for the pigment frequently contain very varying amounts of iron or of chlorides, and the markings will then show reactions of different intensity when tested with the respective reagents. Titanium is also a common constituent of natural graphites, but only in one instance, in a modern Conté pencil, has the writer found a composite pigment to contain sufficient titanium to give a distinct reaction in the markings on paper. In that case, however, a colour test alone was sufficient to distinguish the marks made with that pencil from those made with any other pencil examined.

REFERENCES

Forensic Chemistry. By A. Lucas. (Arnold, 16*s.*)
Inks : their Composition and Manufacture. 2nd Edition. By C. Ainsworth Mitchell and T. C. Hepworth. (Griffin, 9*s.*)
Documents and their Scientific Examination. By C. Ainsworth Mitchell. (Griffin, 10*s.* 6*d.*)

NEW DISCOVERIES IN EGYPT

As we go to press the first news of what will, no doubt, prove to be the most remarkable archæological find of the century has reached this country. The discovery was made by Lord Carnarvon and Mr. Howard Carter, and has resulted from their prolonged excavations in the Valley of the Kings near Luxor, in Upper Egypt. The message to *The Times* says

[*Continued at foot of page 28.*

Belief in After Life Amongst the Greeks and Romans—I

By W. R. Halliday, B.A., B.Litt.

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SPIRITUALISM has been defined as "the belief that it is possible to communicate with spirits of the dead so as to receive from them intelligent messages and proofs of their identity and survival, and as the study and practice of so doing."[1] Traces of spiritualistic belief and practice as thus defined may be found in the records of classical antiquity, and it is also true that some of the instruments employed by some spiritualists of to-day, e.g. crystal gazing, were known to classical divination. But the ordinary procedure of the modern *séance* dates, I believe, from the experiments of the American sisters Fox in the middle of the last century, and we shall naturally look in vain for those spiritualistic theories which are adapted to, or borrowed from, the current working hypotheses of modern science and physics. Further, the present vogue of spiritualism appears to have its origin in one or more of three motives : (1) the hope of regaining personal touch with loved ones who have "passed over" ; (2) the desire to submit the hopes of personal immortality to a quasi-material test ; (3) the hope of acquiring supernatural intelligence as to the course of events past or future with the object of turning the knowledge so acquired to practical account. Of these the third is mainly the motive of classical communication with the dead ; the first two were not, I think, widely operative.

In the Homeric poems, which are the earliest literary account which we possess of a Greek society, the belief in personal survival of a certain kind is indicated. The spirit leaves the body with the breath ; it retains human shape, but is incorporeal and resembles a figure seen in a dream. There is no resurrection of the flesh. When Odysseus met the spirit of his dead mother, "thrice I sprang towards her and was minded to embrace her ; thrice she flitted from my hands as a shadow, or even as a dream, and sharp grief arose ever at my heart." In answer to his complaint, his mother's spirit explains : "Even on this wise is it with mortals when they die. For the sinews no more bind together the flesh and the bones, but the great force of burning fire abolishes these, so soon as the life hath left the white bones and the spirit like a dream flies forth and hovers near." Homeric society, of course, practised cremation.

[1] Schiller in *Hastings' Encyclopædia of Religion and Ethics*, *s.v.* "Spiritism."

Immediately after its departure from the body the spirit "hovers near" until the due performance of funeral rites enables it to join the company of the dead. During the interval between death and funeral it can revisit mortals, but not afterwards. Thus the spirit of Patroclus appears to Achilles "in all things like his living self, in stature and fair eyes and voice, and the raiment of his body was the same." It appears in a dream, but is something more than a dream, though equally insubstantial. "Achilles reached forth his hands but clasped him not; for like a vapour the spirit was gone beneath the earth with a faint shriek." But once the funeral rites are over there is a gulf fixed between living and dead. "Never more," says this apparition, "shall I come back from Hades, when ye have given me my due of fire." The ghosts seen in the vision of the second-sighted Theoclymenus in the palace of Odysseus seem to be the ghosts which the suitors are shortly to become, and not visitors from the other world.[1]

In the next world the life of spirits is a feeble replica of their life on earth, and a phantom Orion eternally pursues his phantom quarry. "Rather would I live above ground," laments the spirit of Achilles, "as the hireling of another, with a landless man who had no great livelihood, than bear sway among all the dead that be departed." The "strengthless" dead may shake the nerves of a mortal by their appearance, but they have no effective power, and are easily kept at a distance by the menace of a drawn sword. Their cry is inarticulate and feeble like the faint gibbering of bats.

Homer's Conception of the "Other World"

Our knowledge of the Homeric "other world" is mainly derived from the XIth book of the *Odyssey*, in which Odysseus journeys to its gateway beyond the outer rim of Ocean which Homer conceived as a stream completely surrounding the world in which we live. Here appropriate libations and sacrifices are carried out, and then the throats of a number of sheep are cut over a trench. The spirits flock up to drink of the blood, and each, as he is allowed to do so, becomes thereby articulate. "The blood is the life thereof," and the draught of blood thus supplies the spirits with a temporary life and enables Odysseus to converse with them with profit.

The hero's object in venturing to the gate of Hades is to obtain knowledge of the future from the spirit of Teiresias, the Theban seer. It is important, however, to notice that the powers of the spirit of Teiresias are due, not to his having "passed over," but to the prophetic gifts which he had enjoyed during life. Spirits of the dead as such have no prophetic powers. Some of them are able to tell Odysseus things which he does not know, but these are without exception memories of their experience on earth, and so far are they from possessing omniscience or supernatural knowledge of terrestrial affairs, that the spirit of Agamemnon asks Odysseus for news of his son Orestes.

Hero Worship

The spirit of Teiresias can reveal the future only because the man Teiresias had been a prophet. There are other traces in the Homeric poems of the belief that certain individuals may pass to an existence different from that of ordinary mortals after death. Menelaus was promised that he should not taste of death, but suffer translation to a Paradise which Hesiod afterwards located in the Blessed Western Isles. Cults of such personages may indeed have persisted from the Bronze Age when dead kings and chieftains were certainly the objects of worship, although there is no evidence[2] of posthumous cult at the barrows of Homeric kings. However this may be, in post-Homeric times the worship of the spirits of such outstanding individuals became popular throughout the Greek world. Many of the "heroes," as these semi-divine beings were called, were no doubt legendary persons, but in the view of their worshippers they had all once lived as mortal men. Such apotheosis after death was in fact extended to historical persons. For example, the famous Spartan general Brasidas was worshipped as a "hero" by the people of Amphipolis immediately after his death in 422 B.C. The real or supposed tomb of the hero was often, but by no means invariably, the site of his cult. Regular features of hero-worship were divination and healing, and the method normally employed was that of incubation, i.e. the inquirer or patient slept at the sacred spot and was visited during the night by the hero. It is natural that the same confusion between dream and apparition which we noticed in the episode of Patroclus' visit

[1] "Then the god-like Theoclymenus spake among them: 'Ah, wretched men, what woe is this ye suffer? Shrouded in night are your heads and your faces and your knees and kindled is the voice of wailing, and all cheeks are wet with tears and the walls and the fair main-beams of the roof are sprinkled with blood. And the porch is full, and full is the court of ghosts that hasten hellwards beneath the gloom, and the sun has perished out of the heaven and an evil mist has overspread the world.' So spake he and they all laughed sweetly at him." *Odyssey*, xx. 350 foll. Butcher and Lang draw attention in their note to the very close and detailed analogies in the recorded stories of second sight in Scotland and Scandinavia.

[2] The reader should be reminded that on Sir William Ridgeway's widely accepted explanation of the *Origin of Greek Tragedy*, set forth in his book with that title, such evidence is plainly afforded by many Greek plays, notably by the *Choephoræ* ("Libation-bearers," i.e. to the tomb of Agamemnon) of Æschylus, and the *Ajax* of Sophocles – Ed.

to Achilles is a frequent feature of the communication between hero and worshipper.

This communication with a spirit which has undergone apotheosis is covered by the definition with which we started, but it will be seen that the analogy to the communication attempted by modern spiritualism is not close. Hero worship is in fact exactly analogous to something quite different—the worship of saints.

Ancestor Worship

Some "heroes" were, of course, the imaginary ancestors of their worshippers; in popular usage the word "heroes" came to be used as equivalent for spirits of the dead, and at several points hero-worship and ancestor-worship touch. Their assimilation was no doubt assisted by the growth of the practice already noticed of deifying distinguished persons immediately after their death. Amongst other less complete documents of similar character we possess the will of Epikteta, a lady of wealth and position in the island of Thera at the close of the third or the beginning of the second century B.C. She makes testamentary provision for the endowment and maintenance of a family religious association to perform in perpetuity commemorative sacrifices in honour of the spirits of her husband, her two sons, and herself. A shrine, *heroōn*, like that dedicated to a "hero" or saint, is to be maintained in their honour, and the living relatives assembled at the service are allowed to eat the meat of the sacrifice, which therefore partakes of the nature of a family sacramental meal. This is an interesting feature, emphasising, as it does, the friendly character which is, upon the whole, characteristic of the relations existing between the Greeks and Romans and their ancestral spirits. For the practice enjoined infringes the general rule of Greek religious custom, according to which a distinction was usually drawn between Olympian divinities and gods or powers connected with death, and the underworld. In sacrifices to the former the flesh of the victim was cooked, and the worshippers partook of it; sacrifices to the latter were normally holocausts in which the victim was completely consumed by fire.

The will of Epikteta belongs to an age in which the belief in personal survival was generally held, but if we may judge from the older ceremonies of Greece and Rome, it would seem that ancestor-worship does not necessarily imply a belief in the survival of personality. In early Rome, before Greek ideas had transformed the native beliefs, it seems improbable that there was any conviction of individual personal survival. At death the spirits joined the undifferentiated collective group of ancestral spirits whom the Romans called *Manes*, but there is no evidence in early times of any religious belief or ceremony directed towards an individual spirit of a dead man or ancestor. In fact the early Roman had no singular noun by which to express such a conception, and even when later the idea of personal survival had been acquired, Latin was forced to use the plural *Manes* to denote the singular spirit of an individual dead man.

Relationship between Dead and Living

I am inclined to think that in early Greece the relationship of the living to the ancestral dead may have been somewhat similar—a relationship, that is to say, between two groups rather than between individuals. At Athens an ancient festival called *Genesia* seems to have resembled the Roman *Parentalia* in general character. The object of its commemorative rites was the plural "ancestors" (γονεῖς), a collective group of spirits like the Roman *Manes*. Upon the Attic festival of All Souls, the *Anthesteria*, offerings of porridge were made to the family dead, and at its close they were bidden to depart until the following year. "Begone, spirits, it is no longer *Anthesteria*." These ceremonies, and such superstitions as the belief that the dead members of the family were present unseen at the family meal, and that food accidentally dropped upon the floor must be left undisturbed for their consumption,[1] reveal a kindly relationship as existing between dead and living. Indeed, few societies have been less ghost-ridden than the Greek.

Such ceremonies as these, concerned with the collective group of spirits of the dead, do not in themselves presuppose individual personal survival after death. The conviction of the existence of a future life in which the individual soul survived to undergo reward or punishment appeared, as we shall see, at an early date in Greece, although it came from a foreign source. It affected all subsequent religious and metaphysical speculation, and increasingly it passed into common or popular acceptance. But it may be worth while to emphasise, in conclusion of this part of my paper, the markedly social or civic attitude not only towards religion, but towards life in general, which distinguished at least the earlier Greeks and Romans from the moderns with their essentially individualistic outlook. Indeed, as long as the city state retained its full vigour and resisted the encroach-

[1] Somewhat similar was the practice at the old Prussian funeral feasts. "If any morsels fell from the table, they were left lying there for the lonely souls that had no living relations or friends to feed them. When the meal was over, the priest took a broom and swept the souls out of the house, saying: 'Dear souls, ye have eaten and drunk. Go forth, go forth.'" Frazer, *The Golden Bough*, pt. ii, *Taboo and Perils of the Soul*, p. 238.

ments of cosmopolitanism and individualism, this markedly social or political attitude towards life remained strong. What I mean by this may perhaps be illustrated by a quotation from the Funeral Speech which Thucydides represents as having been delivered by Pericles in honour of those who had fallen in the first year of the Peloponnesian War. To the bereaved he offers this consolation: "I know it is not easy to give you comfort. I know how often in the joy of others you will have reminders of what was once your own, and how men feel sorrow, not for the loss of what they have never held, but when something that has grown dear to them has been snatched away. But you must keep a brave heart in the hope of other children, those who are still of an age to bear them. For the new-comers will help you to forget the gap in your own circle and will help the city to fill up the ranks of its workers and its soldiers." *The temper of this consolation perhaps prepares us to learn that, although during the Peloponnesian War one of the psychological results of prolonged strain manifested itself in a great vogue of prophecy and of religious emotionalism in general, this did not, so far as I am aware, take the same form of a passionate hope of effecting communication with the spirits of the fallen, which has been the characteristic feature of our own time.*

(*To be continued in the February No.*)

BIBLIOGRAPHICAL NOTE

The most important books dealing with these matters are Rohde, *Psyche: Seelenkult und Unsterblichkeitsglaube der Griechen;* and Farnell, *Greek Hero Cults and Ideas of Immortality*. Some references with regard to necromancy are collected in Halliday, *Greek Divination*. An entertaining, if slight, little book is Collison Morley, *Greek and Roman Ghost Stories* (Blackwell, 1912). Warde Fowler's *Religious Experience of the Roman People* gives an admirable account of the early belief of Italians and their development into the Roman state-religion and subsequent decay.

Festivals Celebrating Local Saints in Modern Egypt

By Winifred S. Blackman

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OWING to the fertility of its soil, Egypt, as far as the necessities of life are concerned, has always been largely self-supporting. But from the earliest times, as the ancient records show, numerous commodities were imported into the country by foreigners, or else by the more ambitious of the native merchants themselves, who ventured far afield to obtain such goods in return for their own products. The richly endowed temples would have been generous purchasers not only of home products, but also of foreign goods, such as incense, which played so important a part in the elaborate ceremonial of the daily liturgy, panther skins which were required for the fashioning of the vestments of certain priests, and sweet-smelling unguents.

Thus in Ancient Egypt, as in many other countries,[1] commerce and religion were closely associated. Such also is no less the case in Egypt at the present day, as is particularly noticeable at the *mūlids*, or annual festivals of the local sheikhs or saints.

The Mūlid en-Nebi, the annual celebration of the birthday of the Prophet, ranks, of course, as the most important of such festivals among the Mohammedan section of the population. However, in this article I shall content myself with a description of three *mūlids* in honour of local village saints, which I myself attended during my stay in the more unfrequented parts of Egypt last winter.

Each village has its local sheikh, whose dome-shaped tomb forms its most prominent architectural feature, rising up among the crowded hovels of the *fellāḥīn* (peasants), or standing on the highest point of the adjacent burial-ground. Sometimes a village can lay claim to two or more sheikhs.[2]

The *mūlids*, at which I was present, took place at El-Lahūn and Dimishkīn in Fayūm Province, and at Manial in the province of Beni Suēf.

FESTIVAL AT EL-LAHŪN

I propose to describe them in the order of their occurrence, the first being that held at El-Lahūn in honour of the Sheikh Umbārak, whose tomb stands in an old disused burial-ground situated on the outskirts of the village (Fig. 1). The whitewashed walls of this tomb are decorated outside with pictures descriptive of the pilgrimage to Mecca, roughly sketched in red and blue paint. Around the dome are small, what one might almost call clerestory windows, in each of which a lighted candle is placed every night. The light afforded by this illumination is a welcome break in the surrounding darkness to the traveller, who, returning home after night has fallen, has to pick his way through refuse-heaps, piles of stones or mud—the invariable obstacles to one's progress along the narrow, tortuous lanes of an Egyptian village.

[1] Cf. Robertson Smith, *The Religion of the Semites*, p. 461. London, 1907.

[2] The word *sheikh* means literally an old man. It also signifies the head of a tribe, the leading man in a village, a learned man (i.e., one learned in the sacred writings), and a holy man or saint, living or dead.

The *mūlid* of the Sheikh Umbārak began at 2 p.m. on April 14, on the morning of which day similar festivities were inaugurated in certain neighbouring villages in honour of their own particular sheikhs. A large crowd collected in the vicinity of the sheikh's tomb, several people, chiefly women, seating themselves around it on the outside. A blind woman, "the servant of the sheikh," was receiving donations from the faithful on his behalf. As the donors presented their gifts, they recited the *fatḥah* (the opening chapter of the Ḳur'ān) in low and rapid tones. In the road which ran past the burial-ground, and in the adjacent

FIG. 1.—THE TOMB OF THE SHEIKH UMBĀRAK AT EL-LAHŪN.

palm-grove, large crowds of people were enjoying themselves, and along the roadside booths had been erected wherein butchers, and vendors of sweetmeats, toys and other wares, plied their trade, to all appearance doing excellent business.

GAMES WITH COLOURED EGGS

Eggs, dyed a bright cerise, are a special feature of all these *mūlids*, and those who sold them attracted a considerable number of customers. These coloured eggs are used for two games, which are played as follows. In one of them two boys or men take part, each grasping an egg in his hand. One of them knocks his egg against that of his opponent, and the man whose egg is not cracked is regarded as the winner and takes the cracked egg of his adversary. In the other game several eggs are arranged in a row on the ground, and a number of men sit at a certain distance away from them. Each in turn rolls an egg towards the row of eggs facing him, and the man who first succeeds in cracking one of them wins the lot. These games, which were played by large numbers of people at all the *mūlids* that I witnessed, are an interesting study for the anthropologist, coloured eggs being used for games, in many cases similar to these, in various parts of Europe, especially in the Balkan States. Again, in most of the northern counties of England coloured eggs are still used in a game which is played on Easter Monday, and which closely resembles the second Egyptian game described above. I remember being presented, when a very small child, with one such egg which was dyed a deep purple.

Other attractions were not lacking at this *mūlid* of the Sheikh Umbārak. In the palm-grove, a conjuror in one part and a poet in the other had collected large and interested audiences. The poet was accompanied in his recitations by a woman, and sometimes by two or three men as well, she and they each beating a single-membrane drum. Peep-shows also contributed to the amusements, the pictures shown usually representing favourite national saints, and heroes and heroines. Lastly, roughly made little cars hung on wheels, which turned round and round, were much patronised by the children.

The intense heat, the swarms of flies, and the dust kicked up by the excited pleasure-seekers, all contributed to the general discomfort of a mere English spectator like myself! However, the friendly welcome I received wherever I went more than compensated for these evils.

A special sheikh (i.e. a holy man of this district), who would later on conduct the *zikr* in honour of the sainted Umbārak, paraded through the crowd on a donkey, preceded by three men carrying large banners decorated with various designs and inscriptions, and by musicians playing on cymbals and a double-membrane drum. The same banners are used at the *mūlids* of other sheikhs at some of the neighbouring villages, and are kept, when not in use, in the house of "the servant" of the Sheikh Ṭayyib at Hawāra. The men who carry them advance with dancing steps instead of an ordinary walk.[1]

The festival was conducted with the utmost good humour, the behaviour of the crowd being perfect. It came to an end at 7 p.m., when the gaily dressed little girls, their mothers, fathers, and brothers,

[1] A similar ceremonial gait was a feature of certain ancient Egyptian religious performances, for which see Hermann Kees, *Der Opfertanz des ägyptischen Königs*, Leipzig, 1912.

retired to their homes to rest and to discuss the pleasures of the day.

Festival at Manial

On the following day the annual *mūlid* of the Sheikh Ṣabr was celebrated at Manial, a small village picturesquely situated on the bank of the Bahr el-Yūsuf.

At one end of the village stands a large tree of considerable age, said to mark the resting-place of the sheikh, though perhaps originally there was a domed tomb as well, which has now disappeared. However, the sheikh is at the present time definitely associated with the tree. I noticed that several large nails had been driven into the trunk, many of them having human hair twisted round them, the hair varying in colour from very fair to dark brown. These nails are hammered into the tree by a suppliant, when he or she makes a request to the sheikh. Thus a man or woman suffering from headache or other ailments will come to the tree, offer up a petition for recovery, knock a nail into the trunk, and then often twist round the nail some of his or her hair; a cure being, it is supposed, sure to follow this procedure. Childless women also visit the sacred tree in order to be cured of their barrenness. The Sheikh Ṣabr is much venerated, not only by the inhabitants of his own village, but also by those of the surrounding villages. He is looked upon as a very good man and as most benevolent to those who seek his aid.

A Religious Dance and other Features of this Festival

In view of the veneration paid to this sheikh, a very large crowd had assembled in the neighbourhood of his tree by the time that I arrived on the scene—some time before noon. As I rode on my way to the village through the cultivation, I passed a number of people, both old and young, on their way to the festival. When I joined the crowd I found the usual brisk trade going on, some of the vendors of wares having erected rough booths, under which they could take shelter from the fierce rays of the sun. Toys, cheap ornaments, brilliantly coloured sweetmeats, and other delicacies, were being eagerly purchased. A fairly large *zikr* was taking place under the shade of the branches of the sacred tree. It was executed by a number of men forming a circle round a sheikh who conducted this religious exercise. The men swayed rhythmically from side to side, nodded their heads, or bent backwards and forwards, as they pronounced over and over again the name of Allāh. The presiding sheikh beat time by clapping his hands, while now and then a *fikīh* would chant passages from the Ḳur'ān. The whole ceremony was conducted with great earnestness and solemnity. Close to where this religious performance was taking place was to be found the usual large wheel, with its hanging seats, where the children congregated in large numbers, all clamouring for a ride, as they are to be seen doing about the whirligigs provided at the big fairs in England. At another spot a poet had collected a large audience, that listened with evident enjoyment while he recited to the accompanying beats of two tambourines and a shallow, single-membrane drum. He was the same poet who had attended the *mūlid* at El-Lahūn. The banners were much in evidence at this festival, and I managed to secure a good photograph of them and their bearers as they stood grouped together under the sheikh's tree, along with a few musicians, and the inevitable crowd (Fig. 2).

Having been most hospitably entertained by the

Fig. 2.—BANNERS OF THE SHEIKH AT MANIAL UNDER THE SACRED TREE.

'omdah of the village, and the festival having come to an end, I returned to El-Lahūn, passing, as I rode along, the sacred banners, which were being carried back by a party of boys to their resting place at Hawāra.

Festival at Dimishkīn

The third *mūlid* at which I was present, namely, that celebrated at Dimishkīn, took place on Friday, April 21. As this village lies a considerable distance from El-Lahūn, I started fairly early in the morning, riding in company with a goodly number of people. The regular starting-off point was the little railway station at El-Lahūn, where several primitive-looking vehicles were waiting to convey the would-be visitors to the *mūlid*. The children, as is customary, were decked out in their brightest and best clothes, and several of them, along with some women, were closely

Insulin and the Gland Treatment of Diseases

By R. J. V. Pulvertaft, B.A.

THERE are fashions in medicine at least as transient, as varied, and as emphatic as in feminine clothing. We have passed through the age of "humours," when the body was supposed to be at the mercy of vague warring influences, which swayed it hither and thither; we are now in the hey-day of the gland theory; the old "humours" are to-day called "hormones," or "excitants," and we are well content with the new name. But behind the large amount of absurd speculation which fills the advertising pages of medical papers, there is a great deal of valuable truth. "Insulin," the new substance which is used in the treatment of that fatal disease, diabetes, is the latest production of this age's medical fashion—untried, to any large extent, as yet. And, while we bear in mind that there is such a thing as transatlantic optimism, it appears that much may be expected from it.

A French scientist, Brown-Séquard, in 1891, was the first to use extracts of animal glands to treat bodily ailments. He employed preparations of the sex glands of dogs to ward off old age in men. Metschnikoff, a Russian scientist, welcomed this notion as the promise of eternal life, when combined with a wise discretion in diet and a devotion to sour milk! Perversely, we still die; we "grow old as doth a garment." But Brown-Séquard grasped the idea that the blood in flowing through an organ might be so changed that it would affect other organs. The new substance so produced was called in 1902 by Bayliss and Starling, two contemporary English physiologists, a "hormone." The field has widened ever since; to-day we may, as a recent writer has ironically pointed out, eat like Alice in Wonderland of one gland-mushroom and be a giant, of another and be a dwarf.

The *pancreas*, a digestive gland, is one organ capable of so altering the blood that it produces far-reaching effects on the chemistry of the body. We argue this from the effect of disease of the *pancreas* in causing diabetes; and from the production of diabetes in dogs on removing this gland or destroying certain parts of it. But the argument that extract of *pancreas* would cure this disease is not necessarily valid, for in a disease which follows on destruction of another gland, the *suprarenal*, glandular extracts have proved very disappointing.

However, there is one well-known case where gland-extracts certainly improve conditions—a certain type of dwarfish idiot known as a cretin is greatly improved physically and mentally by being fed with thyroid gland from the neck of a sheep. And there are certainly many abnormal conditions of growth which depend on the workings of a small gland near the brain, called the *pituitary*. Charles Byrne, the Irish giant, whose skeleton is preserved in the museum of the Royal College of Surgeons, was an extreme example of an over-secretion of a part of this gland, associated with a gigantic stature; the fat boy of Peckham owed his girth to its diminished activity; and perhaps Hop o' My Thumb of the fairy-tale was one of a group of tiny miniature men, whose stunted growth is attributed to destruction of the pituitary gland.

The truth underlying the gland-treatment of diseases would appear to be that our body must be considered as a whole. There is a balance between the workings of one organ and another; by the blood-stream and by the nervous machinery of the body a due proportion is preserved. If a gland is for practical purposes absent, as in the dwarfish idiot alluded to, gland-extracts are of service. But when a disease attacks the body, it is no simple matter to discover where the real trouble is; the changes in the *pancreas* may be only a sign of the wider and more obscure changes in diabetes. Up to the present, extracts of *pancreas* have not brought more than transient relief; it remains to be seen whether the new and more stable "Insulin" will prove to be efficient.

REFERENCES

Glands in Health and Disease. By Dr. B. Harrow. (New York, E. P. Dutton & Co., 1922.)

Lancet, Saturday, November 18, 1922.

Principles of General Physiology. By W. M. Bayliss. (Longmans, Green & Co.)

Between the Covers

WATER-POWER IN THE BRITISH EMPIRE

IN November 1917 a Committee was formed by the Conjoint Board of Scientific Studies to investigate the resources of the British Empire for the production of hydraulic power. Subsequently a Board of Trade Committee considered the water-power of the United Kingdom. The reports of both Committees have now been published, and in his preface to *Water-Power in the British Empire*, a collection of the reports of the first-mentioned Committee (Constable & Co., Ltd., 3*s.* 6*d.*), Sir Dugald Clerk, K.B.E., F.R.S., Chairman of the Committee, and also a member of the second Committee, is able to give a most interesting outline of the present position. "The coal position of the world must deteriorate from decade to decade," and the obvious substitute for coal and oil is water-power.

"The world," writes Sir Dugald Clerk, "may be

packed together in one or two of the clumsy, jolting carts. Many people, however, denied themselves such a luxury as a conveyance, and started off on foot, heedless of the discomforts inevitably attendant upon the south wind that was then blowing—blasts almost as hot as those issuing from the mouth of a furnace, clouds of fine suffocating dust, and swarms of flies. I passed a number of these optimistic pedestrians as I rode along on my donkey, some of them being women carrying their babies.

On arriving at Dimishkīn I found a large crowd

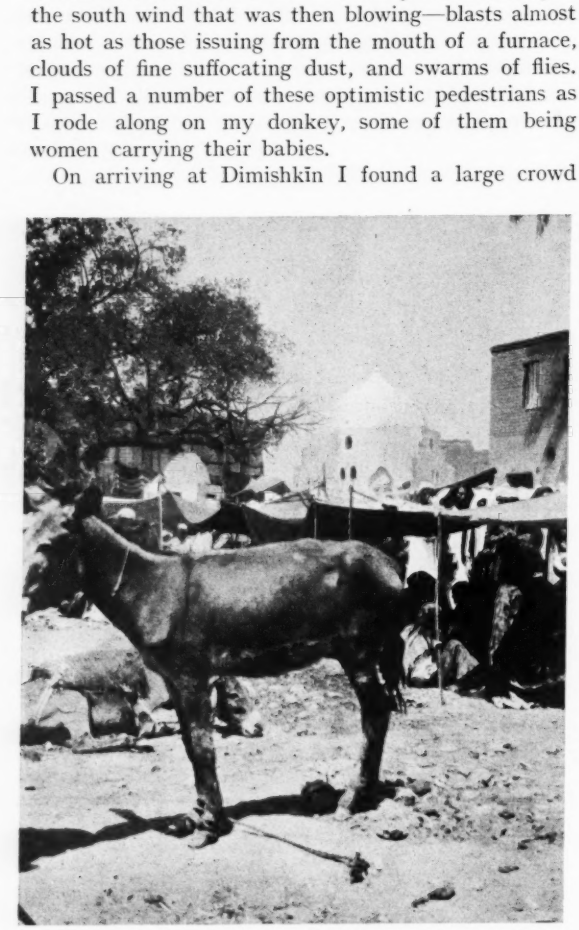

FIG. 3.—*MŪLID* AT DIMISHKĪN, WITH THE SHEIKH'S TOMB AND TREE ASSOCIATED WITH IT.

assembled around the tomb of the Sheikh Farrāsh en-Nebi, whose *mūlid* was being celebrated. This tomb was situated close to the village, and, as usual, a large tree [1] was associated with it, booths being set up under the shade of its wide-spreading branches (Fig. 3). Here again a large *zikr* was in progress, those taking part in it having secured themselves a sheltered position near the tree. At some distance from the tomb was a concourse of people, all intent on playing the games with the coloured eggs. The same poet officiated at this *mūlid* as at the two former festivals, the same brisk trade was going on, and the crowds also showed the same good-natured enjoyment.

[1] Similarly in ancient times a tree or grove of trees was attached to the various tombs which were supposed to contain a portion of the body of Osiris. See, e.g., H. Schäfer, *Das Osirisgrab von Abydos und der Baum* pḳr, in *Zeitschrift für ägyptische Sprache*, vol. xli, pp. 107–10; Junker, *Das Gotterdekret über das Abaton*, Wien, 1913, pp. 12 ff., 50 ff.

ORIGIN OF *MŪLIDS*

It is probable that such festivals, which take place at various dates all over Egypt, can claim a very ancient ancestry. In quite early times there were festivals, celebrated at stated seasons, in honour of the various local divinities, and in celebration of certain calendar events, that attracted considerable crowds. Moreover, as at the modern *mūlids*, there was a good deal of brisk trafficking carried on in conjunction with the religious performances, merchants coming from considerable distances, by boat or caravan, laden with their wares, which found ready purchasers among the assembled crowds. An inscription in the great temple of Denderah describes such a festival in the following terms: "The gods of heaven shout for joy, shout for joy . . . The Ḥathors [i.e. the dancing girls impersonating that goddess] beat their tambourines [more accurately "single-membrane drums"] the August Ladies wear their *menit*-collars. Those who are gathered together in Denderah are drunk with wine and garlands of flowers are on their heads. The sailor-folk of Edfu [i.e. the crews of the boats that have come from that town] walk joyously about, being anointed with the finest unguent. All the children rejoice, making jubilation for the Golden One (Ḥathor), from the rising to the setting of the sun." [2]

In one respect the modern Egyptians are certainly superior to their ancestors, for I never saw a single case of drunkenness or bad behaviour at any of the three *mūlids* at which I was present.

MŪLIDS AND ENGLISH FAIRS

The modern *mūlids*, as also their ancient prototypes, show striking resemblances to our own English fairs, especially as celebrated during the Middle Ages and on into the seventeenth century—these being associated in every case with a saint and also with trading. Our modern fairs, though often still named after the saints in whose honour they were originally held, have now lost their religious significance. But one which I attended after my return to England reminded me in many ways of the *mūlids* which I had recently witnessed just before my departure from Egypt.

[2] *Duemichen, Altägyptische Tempelinschriften.* Leipzig, 1867. Pl. xxxviii, lines 16–19.

considered as a huge solar engine, in which the waters of the seas are evaporated by the heat absorbed, and much of the vapour carried to high levels, at which it is deposited as water, and flows down to the sea. By this process we get a complete cycle of operations, including evaporation of water into steam, condensation of the steam into water, evaporation again, and so on. In falling from the high level to the low level of the sea, power can be obtained from this water. Hydraulic power, in fact, is a form of sun-power, and will continue in existence long after all the coal and oil in the world have been exhausted. Coal and oil have also been produced by the action of the great solar engine, and they contain a portion of the energy of radiation of past ages, stored up in the growing wood and leaves of plants, accumulations which are now being rapidly drawn upon by mankind. Coal and oil are thus the result of past radiant energy, while wind and water power are due to present radiant energy. In one case the store in the earth is being used up and cannot be replaced ; in the other case, so long as the solar system lasts, power exists also."

Approximately speaking, a total of 1,350,000 h.p. could be obtained from water in the United Kingdom. This total does not include the power available by harnessing the Severn Channel. On this subject the Board of Trade Committee in its report of December 1920 concluded that, "while insufficient data are available to enable a definite opinion as to the economic practicability of the scheme to be expressed, it merits further detailed investigation. It offers a possibility of an output of some 350,000 h.p. daily over a ten-hour working period, corresponding to a saving of 1,270,000 tons of coal per annum on the basis of the consumption in modern large coal-fired power stations."

"The largest installation as yet developed in the United Kingdom is the Kinlochlever Works of the British Aluminium Co. Although the drainage area is only 55 square miles, the high rainfall, amounting to 70 inches per annum, and the large fall of 920 feet, are sufficient to give an output of about 30,000 e.h.p. These works are now being increased by the addition of the power to be obtained from Loch Eilde Mor."

Of the 15,000,000 or 16,000,000 h.p. produced by water-power throughout the world, "it is striking," says Sir Dugald Clerk, "to find that Continental Europe uses water for 27 per cent. of her total motive power, and the United States 24 per cent., while the United Kingdom only used 0·6 per cent. Our Colonies, however, use water at present for 33 per cent. of their total industrial power."

As to the total available amount of hydraulic horse-power throughout the British Empire, "Canada has nearly 27,000,000 hydraulic h.p. available, and when India, New Guinea, and New Zealand are added we attain a potential power of the order of 40,000,000. When we add to this the water resources of East, South, and Central Africa, Egypt, Ceylon, Tasmania, Australia, British Guiana, Burma, the Malay States, and our own Islands, the aggregate hydraulic power of the Empire approaches 70,000,000 continuous h.p.—a truly remarkable power to be used in the present to a small extent and in the future to a very large extent as coal resources become reduced."

WHAT IS A GOOD MEMORY?

"A GOOD memory should obviously be exact. An experience should be recalled without the loss of any characteristic details and—which is just as important—without the gain of any foreign ones. Probably few persons realise how common is the latter event. In recounting a funny experience which has happened to themselves most people are apt not only to drop the unamusing details, but to trim the edges of the focal events so that they dovetail perfectly into each other.

"Since complete recall of any experience is impossible, a good memory should be serviceably selective. To good remembering, as to good art, leaving out the right things is indispensable. The art of forgetting is but the inner aspect of the art of remembering."—Prof. T. H. Pear in *Remembering and Forgetting*. (Methuen & Co., Ltd., London., *7s 6d.*)

WHERE RABBITS SPEND THE DAY

"IF you were to ask one thousand men in any town, or part of the country for that matter, where rabbits spend the day, nine hundred and ninety-nine of them would answer: 'In burrows or holes in rocks, of course,' unconscious of the fact that some rabbits never go near a hole of any sort or kind unless forced there by a dangerous enemy. Many rabbits that live in woods sit out all day long wet or fine, and keepers profess an ability to distinguish them from burrow dwellers by the darker tint of the fur along their backs.

"At certain seasons of the year burrow dwellers will make a nice cosy 'seat' in some rough tussock of grass, and if left undisturbed spend the whole day in it. I have watched rabbits go to their 'seats' in the early hours of the morning on many occasions, but did not know until quite recently that they will sometimes do so, even in the late afternoon.

"Crossing a hill after a heavy shower of snow that had fallen between two and three o'clock one day, I noticed that a rabbit had left a wood immediately on my right, and hopped quite leisurely, as the character of its footprints indicated, out into the rough grass field through which I was passing. Expecting to discover its returning tracks a little farther down I walked on, but was disappointed. Returning to the

point at which the animal had emerged from the wood, I followed its footmarks until I came upon it squatting in a nice cosy 'seat' under a bush. There were plenty of good burrows in the field it could have taken to for safety, supposing it had been driven out of the wood by a pursuing enemy, but the fact that it had entered the field in quite an unperturbed state of mind, and had not attempted to go near any hole or burrow, entirely mystified me as to why it should be going to rest at such a peculiar hour of the day."—Richard Kearton, F.Z.S., in *At Home with Wild Nature*. (Cassell & Co., 7*s.* 6*d.*)

Railway Electrification

By S. R. Roget, M.A., A.M.I.E.E.

THE "electrification" of railways, or as some engineers prefer to call it, the conversion of railways to electric traction, is a matter which is receiving more and more attention in all parts of the world. Its progress was considerably retarded by the war and the conditions induced thereby, but there are, at the same time, in these conditions themselves features which increase its advantages and may render the adoption of electric traction on the railways of the world ultimately more universal, even if somewhat delayed. Before discussing this present-day aspect of the problem, however, it may be of interest to look back a little into the nature of the technical problems which have been faced, the systems which have been developed to meet them, and the directions in which practice is pointing to the future.

Broadly speaking, electric traction comprises any system in which an electric motor propels a vehicle by driving its wheels, or otherwise exerts a force to move it. The current which provides energy for the purpose may be supplied from a stationary source or from one moving with the vehicle. On electric railways the source of energy is usually a fixed generating station whose power is provided by steam turbines, engines, or other prime movers, or by water-power, the motors being carried on the train; for it is not practicable to drive trains by storage batteries, nor is haulage by fixed electrically driven machinery suitable except for such special cases as short mountain lines carrying comparatively light loads.

TRAMWAYS

The very earliest examples of electric traction were experimental, and out of them grew the familiar electric tramway. In the typical electric tramway, two electric motors on each car, mounted on the underframes or bogies, drive the axles through gearing, and continuous current (i.e. current always flowing in the same direction) is supplied from an overhead wire by a "trolley" or other contact device, and returns to the generating station through the running rails and the earth. The system is satisfactory from a technical point of view. One of the principal troubles experienced was in connection with the return current through the earth. As the rails were not insulated, the return current sometimes wandered through the ground and, passing through any buried pipes or other metal-work on its way, caused serious corrosion by electro-chemical action. Means were, however, found to keep the return current within reasonable bounds through limiting the pressure which could exist between rail and earth by introducing a few volts in the opposite direction by an auxiliary apparatus known as a "booster" in the station. In very exceptional cases the earth return has been abandoned and two overhead wires employed, notably in the case of certain lines near Greenwich Observatory where the stray return currents would be liable to interfere with observations of terrestrial magnetism.

DEVELOPMENT OF ELECTRIC RAILWAYS

The earlier and many of the present electric railways, whether formerly worked by steam or not, are in their essentials practically enlarged electric tramways. Naturally this increase in scale introduced various special conditions which brought about modifications and developments. It is a far cry from the single car with its comparatively simple controller, by which the driver regulated the supply of current to the motors, to the large passenger motor-coach, any number of which can be joined together, with or without other motorless coaches, to form a train. In some cases, particularly where old steam rolling stock or through trains running on to steam-worked lines have to be handled, or in goods traffic, or on long-distance lines worked at high pressures, electric locomotives upon which all the electrical apparatus is concentrated are preferable, and here the departure from tramway practice is most complete.

VARIOUS SYSTEMS OF CURRENT SUPPLY TO THE TRAINS

The increased powers and distances dealt with also made it advisable to take advantage of the economy in transmission presented by "alternating" currents (i.e. currents which change their direction many times a second) owing to the ease with which such can be generated at, or "transformed" up to, high pressures; for the higher the pressure, the smaller is the current required to convey a given quantity of energy. This system, however, requires a number of sub-stations at

points along the line to convert the current to continuous current at a pressure suitable for the trains, if the advantages of continuous-current motors, in the power they will develop over a wide range of speed, are to be retained. These sub-stations entail running machinery, and the cost of their equipment, maintenance, and operation is a considerable matter to be reckoned with. The use of alternating current transmission and converting sub-stations is not limited to heavy railways, but is employed in some of the larger tramway systems such as the London County Council's.

At the voltages necessary for the ordinary continuous-current traction motor of the days we are speaking of, an overhead conductor for working heavy trains would have been of unwieldy size, so the insulated "live" conductor rail along the track was used instead. The system was thus arrived at which became practically standard for urban, suburban, and what is sometimes called interurban working, where the traffic is dense enough to justify the cost of numerous sub-stations. In London, for instance, the great power house at Lots Road, Chelsea, supplies alternating (three-phase) current at 11,000 volts to a large number of sub-stations distributed all over the London area, where it is converted to continuous current at about 600 volts, at which pressure it is supplied to the conductor rails and picked up by the trains. In this way Lots Road runs the District Railway, nearly the whole of the Tube Railways, and a small portion of the London United Tramways. A similar system is used by the Metropolitan, Great Western, London and North Western, London and South Western Railways for their suburban lines, and is employed for many lines of like nature in other countries.

For long distance and less dense traffic, however, the cost of these converting sub-stations is a very serious item. One way in which the problem has been solved is by using alternating currents throughout,

FIG. 1.—NEW SINGLE-PHASE LOCOMOTIVE FOR THE RHÆTIAN RAILWAY, SWITZERLAND.

because such currents can be changed in pressure or transformed without running machinery. This enables much higher contact-line pressures to be used with correspondingly lower currents for which overhead conductors are again suitable. The most widely used alternating-current traction system is that known as "single-phase," in which a simple alternating current requires only one overhead wire, and an earth return. The motors for this system were developed later than the continuous-current railway motor and are somewhat similar, although they are controlled rather differently, and in some ways are not so satisfactory. The single-phase system is considered by many to be

good, especially for main lines, and is at present in use on the London, Brighton and South Coast Railway, where the system was adopted with a view to the ultimate conversion of the whole system after the suburban sections had been electrified. On the Brighton railway the overhead line pressure is 1,500 volts, but on the Continent, where longer distances and sparser traffic are the rule, the pressure used is in some cases ten times this amount. 15,000 volts is the pressure used on the main lines of the Swiss Federal Railways, the whole of which are being gradually converted to electric traction.

As an example of up-to-date practice in the field of single-phase traction, we are able, through the courtesy of Messrs. Brown, Boveri & Co., Ltd., to illustrate in Fig. 1 one of a group of single-phase locomotives which they have supplied to the Rhætian Railway in Switzerland, a narrow gauge line of severe gradients and curves including the lines connecting Coire and Dissentis with St. Moritz, Davos, etc., on the whole of which electric traction will shortly be used exclusively. This locomotive comprises two trucks, each driven by one large motor mounted on the main frame and geared to a countershaft from which a flexible drive to the wheels is obtained by outside connecting and coupling rods—a system of drive much favoured in Continental locomotives. To give an idea of size, it may be mentioned that the overall length is about 43 ft., and the total weight about 66 tons, of which about 28 tons consist of electrical equipment. The overhead line pressure varies from 7,500 to 11,000 volts, and the motors are fed from a single transformer on the locomotive at pressures up to 520 volts. The two motors, together capable of 950 h.p. continuously, or 1,140 h.p. for one hour, can give a maximum drawing effort of 13 tons at starting and a maximum speed of 28 miles per hour. The motors are kept cool by forced ventilation.

There is one further system of alternating-current traction which was used before the single-phase traction motor was developed. This is the " three-phase " system, which requires two overhead contact lines as well as the earth return, to provide for the currents. Such three-phase current permits of the use of a class of motor, known as the induction motor, which is in many respects simpler than the continuous-current or the single-phase commutator motor. This advantage of simplicity and robust construction is counterbalanced by the fact that it cannot conveniently exert so great a pull at starting and cannot give power above a certain fixed speed called the " synchronous " speed, depending upon the frequency of the alternations of the current. This last feature, however, is a very great advantage for certain cases, such as mountain lines, because if an induction motor be driven above its synchronous speed, say when the train is running down hill, it automatically becomes a generator which, like a brake, limits the speed of descent to a few per cent. above that corresponding to its synchronous speed, but without wasting power in heat like a mechanical brake, as the energy developed is returned into the line. This regenerative braking effect, as it is called, renders the three-phase system excellent for mountain lines, be they of the adhesion or rack type, and in no other system can locomotives be built with so low a weight per horse-power. This system was first used on the mountain lines in Switzerland and has extended to some of the main lines of northern Italy, where steep gradients are plentiful. It is in use on the line approaching and passing through the Simplon tunnel. For ordinary railway work, however, the three-phase motor has disadvantages in that speed regulation below the maximum speed presents difficulties, because such a motor, even with the most complicated control gear, will only run economically at a few submultiples of its synchronous speed. It will be remembered that the three-phase system was at one time seriously proposed for the Metropolitan Railway, and it was only after an arbitration that uniformity of system with the District Railway was attained.

Recently a system has been developed to combine the advantages of single-phase, single-wire distribution with three-phase motors, by employing an apparatus which changes one kind of current to the other on the train, but the system is more or less experimental at present, and would appear to suffer the disabilities in speed regulation already mentioned. In the earlier days of single-phase working advantage was taken of the fact that the single-phase commutator motor could be made to run also on continuous-current circuits, so that the same motors could run in country zones on a single-phase circuit and in urban areas as continuous-current motors. But this compromise was not a happy one, since a motor that is well designed for one kind of current is badly designed for the other.

Although the single-phase system is very suitable for main-line working, and is adopted as the standard for the purpose in Central Europe, it cannot be affirmed that the single-phase motor is as good for use on ordinary railway lines as the continuous-current motor. The equipment to be carried on the train with its transformers, etc., is heavier for its power than the continuous-current apparatus. And in all alternating-current systems there are difficulties in avoiding interference with neighbouring telegraph and telephone circuits.

High-pressure Continuous Currents

Meanwhile improvements in design made both on the continuous-current traction motor and on sub-

station equipment has somewhat upset the balance in the advantages of the systems that we have been discussing. It is now possible to employ contact line pressures up to 3,000 or even 5,000 volts. This system is in use in this country on the Manchester-Bury line of the Lancashire and Yorkshire Railway, and on the Shildon-Newport line of the North Eastern Railway. The same system working at 2,400 and 3,000 volts is also in use in America and elsewhere.

The high-tension continuous-current system is consequently now a formidable competitor of the single-phase system, and the near future should see great extensions in its use. It has already been adopted as the standard for extensions of electric railway working in France, and is being used for important schemes in South Africa and elsewhere. The high line pressure enables the number of sub-stations to be reduced, and recent developments of automatic switch gear enable these to run without continuous attention. The converting sets in any particular sub-station are started up automatically as the line requires power in the section in question, and are stopped when no longer required, their control being effected by the variations in the pressure in the line according to the demand upon it. By this means, not only are labour costs substantially reduced, but greater economy in working is secured.

Standardisation of one System Unlikely

Although standardisation of system is an ideal worthy of sacrifice to attain, every system is worth examination on its own merits. There is no " best " system in every circumstance. In different countries the opinions of experts differ. As said before, the three-phase system appears to suit the conditions in northern Italy, for the Italian engineers still remain true to it, while the single-phase system is being actively extended in Switzerland, and has been accepted as the standard in Germany, Norway, and Sweden. On the other hand, in France, America, and in various parts of the British Empire the high-tension continuous-current system is making rapid headway.

A good example of modern American practice in this direction is presented by the 3,000-volt continuous-current locomotive recently built for the mountain sections of the Chicago, Milwaukee, and St. Paul Railway by the General Electric Company (of America), which is illustrated in Fig. 2 (reproduced from a photograph kindly supplied by the British Thomson-Houston Co., Ltd.). This locomotive is 76 ft. in length overall, and has no less than fourteen axles. The total weight is 265 tons, of which 229 tons are borne by the twelve pairs of driving wheels. The motors are arranged to be used three, four, six, or twelve in series on the 3,000-volt circuit. They can develop 2,760 h.p. continuously, or much more for short periods, and the locomotive, which is designed to pull a load of 900 tons at 25 miles an hour up a 2 per cent. gradient, and can exert a drawing force up to 56,500 lb. There are a number of interesting points about their mechanical as well as their electrical design which render locomotives of this class suitable for high speeds, at which they can travel with an efficiency and steadiness exceeding that of geared locomotives of approximately this size.

In Northern Italy, where conditions are peculiarly suitable for the electrification of railways owing to the ample water-power available in a mountainous district, Messrs. Brown, Boveri & Co. have recently supplied a locomotive for use on the line from Turin to Ceres, which, contrary to the recent preference in Italy for three-phase working, has been equipped for continuous current at a maximum line pressure of 4,000 volts, and is supplied through a single sub-station for the whole 26 miles. Each motor is rated at 140 h.p. for one hour, and the locomotive is capable of a maximum tractive effort of about 9·3 tons and a maximum speed of 40·5 miles per hour.

The extent to which railway electrification is already an accomplished fact may be gathered from the following figures of the route mileage of main lines in different countries already worked electrically, or actually in process of conversion: United States, 1,522 miles; Austria, 489 miles; Italy, 466 miles; Switzerland, 462 miles; and Sweden, 272 miles.

Advantages of Electrification

Speaking generally, and assuming that the most suitable system has been chosen to meet the particular circumstances, the advantages to be gained by the substitution of electric for steam traction are: (1) increased available average speed of trains; (2) increased carrying capacity of the lines and greater economy in fuel consumption per train-mile; and (3) the great advantages of cleanliness in tunnels and in urban areas. These advantages are really those inherent upon power centralisation, but there are other advantages, due to the simplicity and reliability of electrical apparatus, which bring with them a reduction of maintenance and operating costs as compared with the steam locomotive. The increased carrying capacity is mainly due to the much greater accelerating power obtainable because an electric train has all the resources of a large station at its disposal, while a locomotive has only its own. It is this increased acceleration which is of such great value in heavy suburban traffic, where the advantages of electric traction with modern systems of

electric automatic signalling and train control are now undisputed.

For lines of longer distances and less dense traffic, this feature, although still present, does not dominate the situation in the same way. Centralisation in a power house enables fuel to be burnt with an economy unapproachable in the furnace of an isolated locomotive, and presents opportunities for utilisation of other sources of power not otherwise available for railway purposes. In countries where water-power is relatively abundant and fuel expensive, electric traction enables the natural energy of the waterfalls to be used for railway purposes, a point of enormous importance in view of the almost prohibitive rise in the cost of fuel in some countries since the war. This has been the predominating factor in Sweden, Bavaria, and Italy, and in certain parts of America. In other countries different features have formed the deciding reason for adopting electric traction. For example, the main lines outside New York, where heavy railway electrification began in the United States, were electrified after a tunnel accident attributed to an accumulation of noxious gases. Likewise, to avoid smoke in tunnels, the railways through the Baltimore tunnel in America and in the Simplon tunnel on the Continent were electrified. This was also a factor in the adoption of electric traction on the London underground railways. On the Chicago, Milwaukee, and St. Paul line, the power to negotiate steep gradients was the consideration which outweighed all others.

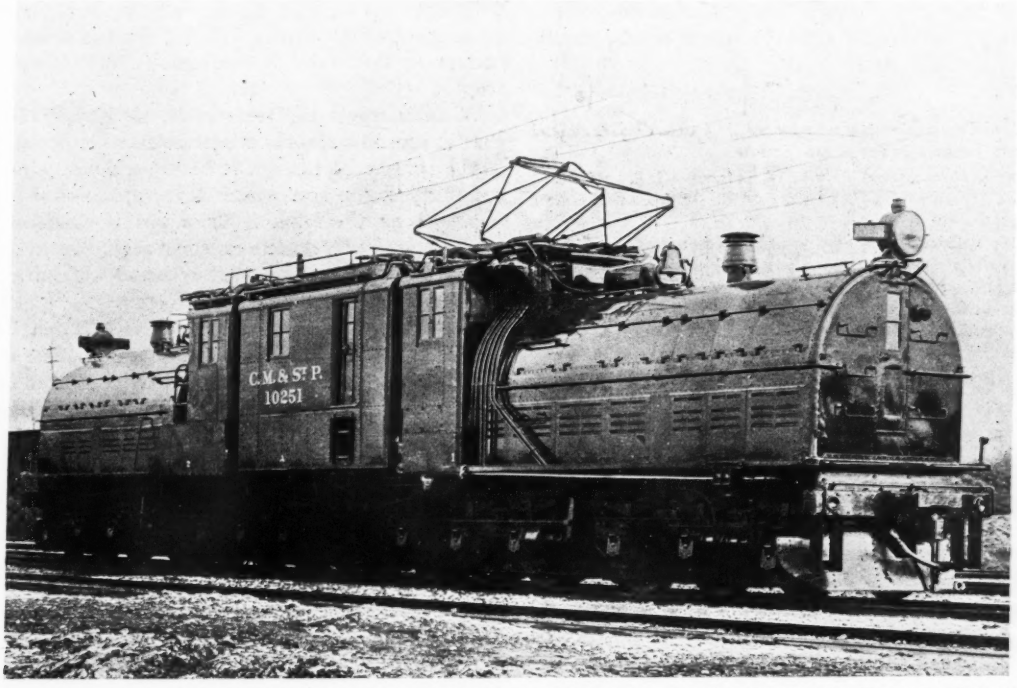

FIG. 2.—A LARGE ELECTRIC PASSENGER LOCOMOTIVE USED ON THE CHICAGO, MILWAUKEE, AND ST. PAUL RAILWAY.
An example of the high-tension current system.

DISADVANTAGES

Against the economy in power production must be placed not only the great capital cost of the plant, particularly great when the power is generated by water from an extensive area, the cost of the transmission of the power where the distances are considerable, interest on capital cost of the line, and its maintenance. Both the capital cost of plant and equipment and that of labour required for maintenance and operation have risen considerably since the war. On the other hand, both the vastly increased cost of fuel and the rise in the cost of labour handicap the steam railway more seriously than the electric, owing to the smaller operating and maintenance staffs required. In many cases, therefore, the comparison from the point of view of running expenses is more in favour of electricity than it was before the war.

ECONOMIC CONSIDERATIONS

The point that must be investigated in each individual scheme is whether the advantages to be expected

laborious lifting of water from rivers or wells, the levelling of fields, the terracing of hillsides, lengthy canals and multitudinous distribution channels.

(3) The desert stage, when rains, rivers, and wells gradually diminish, crops are increasingly uncertain, and the country becomes derelict.

Practically the whole of the lands covered by the ancient empires come now under the last two headings. They are deserts or require irrigation, but when they were first settled they were no doubt in the primary stage of ample rainfall, for with the whole world open to him, man naturally would first choose the best places.

The centres of our modern civilisations are situated in countries in the first stage. They have sufficient rain, and irrigation is only resorted to locally and on a small scale. Is it not probable that no country which does not also come under that category can stand in the forefront of civilisation? Unless it is sure of ample rains and certain crops, such as those obtainable in North Africa, parts of Arabia, Syria, Asia Minor, Mesopotamia, and Persia?

There are many lands where the soil has gone out of cultivation. We blame the inhabitants for neglect, as in the old Turkish Empire. But are we right? Is it not possibly the want of sufficient rainfall which interferes with cultivation? The Turks are often accused of causing the decay of Mesopotamia and Asia Minor, which were so fertile that their rulers became the richest of men, like Crœsus, or the most gorgeous, like Sardanapalus and Mahomet the Magnificent. For centuries after the Turk had made himself master of these then most desirable territories, he lived in wealthy splendour as Caliph at Baghdad.

What is the reason for the decay of the Mohammedan power? Is it not at least possible that the region from which it drew its wealth, food, and human material gradually dried and slipped out of the first stage into the second? His energies were not equal to fighting drought and famine as well as human enemies, his base failed, his wealth disappeared in a few hundred years, and he fell from his high estate to make way for those in the north whose base was more secure.

Roman Cities in the Sahara

The evidence that our deserts were not always the barren wildernesses which they now are is overwhelming, especially so in the case of the Sahara, which has been much explored by the French since they assumed a protectorate over it. A few years ago a traveller called Fisher, an official of the Niger Protectorate, crossed it from Tripoli to Lake Tchad, a distance of 1,100 miles, along an old abandoned caravan route. He very nearly died of thirst, but won through with the greatest difficulty. He states in his book that at every halting-place he found stone buildings, wells, walls, and paved roads, some of which were undoubtedly of Roman origin. He climbed over mountains 4,000 and 5,000 feet high, snow-covered in the winter, and his camels ploughed through miles and miles of sand-dunes that "were only the dried alluvium of vanished rivers, accumulated in places by the prevailing winds." The country passed over was sand here and there, but most of it consisted of a network of water-worn valleys, some of immense size and length, in the hollows of which were the scarce oases and wells which enabled him to live.

In Roman days North Africa was a vast granary, divided into provinces such as Cyrene, Carthage, Numidia, Mauritania, etc., all of which possessed numerous large wealthy cities. Gibbon says that there were three hundred such cities in the district of Carthage alone. To-day all have disappeared, but scores of ruins of towns and vast aqueducts with forests of broken arches dot the plain, and rear their lofty walls as though they were the huge graves of a vanished civilisation. At one site all has been covered by sand except an enormous amphitheatre, towering alone in the hot shimmering desert air, which once vibrated with the groans of gladiators and the applause of the crowded arena. Now it is only the haunt of the lizard and the scorpion.[1]

There is an old Arab saying that "once you were able to walk from Mecca to Morocco in the shade." Those trees are now represented by fossils, which are still to be seen in Egypt standing or lying in their natural positions, but turned into stone.

Decline of Rainfall in Southern Europe

The danger zone has already spread to the countries near the Sahara. Spain, it cannot be denied, has suffered from the vicinity of her dangerous neighbour. She was one of the richest provinces of Carthage and later of the Roman Empire. She was most prosperous in the Middle Ages under the Moors, and in the palmy days of Ferdinand and Isabella. Now she has reached the second stage. Most of her forests have disappeared—the effect, or it may be the cause, of the drought which necessitates irrigation of her parched slopes to produce good returns. A trifling fact will illustrate the change. The Mediterranean coast of Spain is believed to have been the original home of the rabbit, which was brought to England by the Romans. We know how it flourishes in Britain to-day, but its ancient habitat no longer produces enough

[1] See Gibbon's *Decline and Fall of the Roman Empire*, chapter li.

from economy in power supply, increased capacity of the line for traffic, and so forth, are not outweighed by the capital cost of the conversion. An investigation indicates that at a certain traffic density electrical working will show sufficient advantage to justify the capital expenditure, and the higher the traffic density above this critical value the greater will be the advantage. The effect is to some extent cumulative in that the improvement of the service resulting from the change usually creates new traffic, so that the actual results may be even more favourable than were anticipated. Because of this it may be predicted that, given the requisite financial conditions for the raising of the capital, the future will see great developments in the electrification of railways which will be amply justified by their results.

REFERENCES

Books and papers which may be referred to for full technical treatment of the subject of this article:

Railway Electric Traction. By F. W. Carter. (E. Arnold & Co.)

Electrical Traction. By E. Wilson and F. Lydall. (E. Arnold & Co.)

"Electric Railway Contact Systems," *Journal of the Institution of Electrical Engineers*, vol. lviii, p. 838.

"Application of the Electric Locomotive to Main-line Traction on Railways." By H. E. O'Brien. *Journal of the Institution of Electrical Engineers*, vol. lviii, p. 858.

Rainfall and Civilisation

By Colonel H. de H. Haig, late R.E.

IT is about one hundred years since Malthus startled and shocked the world with his theory, that the natural increase of the population must overtake the land surface of the earth on which it lives, because one is growing and the other is fixed and limited. The population is still growing, but it has not yet overstepped the numbers which can be supported. There are still large empty spaces, though unfortunately most of them are almost, if not quite, deserts.

GEOGRAPHICAL POSITION OF DESERTS

If we take an atlas, the first thing that strikes us is that the deserts are not where they might be expected to be, that is, in the hottest part of the earth, on the Equator. The Sahara, for instance, is far to the north of the Equator. There, on the contrary, we find hot and steamy climates like Stanley's Rain Forest of the Congo, the Amazon Region, and the East Indian archipelago. The true deserts lie to the north and south of the Equatorial lands, forming roughly two rings round the earth, north and south of the tropics of Cancer and Capricorn. This points to some general and world-wide cause, which may be the circulation of the atmosphere at the Equator under the sun and the descent of the currents which form the trade winds.

The sun heats the air in the belt between the tropics and in consequence it expands and rises. When it reaches the higher atmosphere it rises above the surrounding air and has to overflow to the north or south. This rise and consequent expansion chills it, and the moisture condenses and falls as the well-known tropical rains.

The air thus chilled, dried, and pushed forward, flows over the warmer air beneath, gradually sinking on account of its greater density, until it reaches the surface of the earth in the regions just outside the tropics.

When it meets the surface the air is very dry, so that it greedily absorbs what moisture it encounters. If the surface be the sea it becomes a wet wind like the rainy south-west winds of Europe, but if it first impinges on the land, it dries up the surfaces and causes the deserts which extend roughly in two rings round the earth, and which seem to be continually tending to extend their boundaries.

Beginning with the Sahara, we have Arabia, Syria, Mesopotamia, Persia, Baluchistan, the Indian desert of Bikanir, and the Gobi. The belt continues in the same latitudes in North America in South California, Arizona, and New Mexico. Similarly in the Southern Hemisphere we have the Australian desert, North Chile, part of Peru, the Atacama Desert, and the Kalahari in South Africa.

DESERTS AS CENTRES OF PAST EMPIRES

It is a significant fact that it is in these regions, obviously the very best parts of the earth's surface in ancient days, that the great nations of antiquity appeared—Assyria, Babylonia, Persia, Phœnicia, the Hittites, Crete, Egypt, Carthage, India, and China, and in the new world the Aztecs and Incas. All of these flourished in lands now suffering from insufficient rainfall, but which with abundant water easily yield two crops a year.

EFFECTS OF CLIMATIC CHANGE ON CIVILISATIONS

There seem to be three stages through which countries pass:

(1) The rich and productive one, when the rainfall is abundant at all seasons, crops are certain, grazing is ample throughout the year, and in warm climates several crops can be raised.

(2) The irrigation stage, when the rainfall is insufficient or badly distributed. This necessitates the

succulent herbage, and in consequence it has almost entirely disappeared there in a wild state.

France has not suffered so much, being farther away, but there are not wanting indications that the climate there has also dried considerably since men have occupied the land.

Italy also, being farther away, has not suffered so much as Spain, but she has begun to irrigate, and only lately opened the longest aqueduct in the world, in Apulia. Also it is evidently the failure of moisture in the Appenines that prevents the enormous production of wool which made Florence for centuries the centre of the cloth trade and the banking house of the world.

Sicily has sadly deteriorated. Once the garden of Europe, the coveted prize possessed by twelve nations in succession, and the granary of Rome, she now grows lemons and oranges by means of irrigation, and maintains a limited existence. She is no longer a prize to be conquered by the dominant race in the Mediterranean. Her uplands are deforested, either the cause or the result of drought, now so acute that sometimes for a whole year scarcely a drop of rain will fall. When Verres was the Governor under the Roman Empire, he made a corner in grain (the first on record) in the Roman market, by checking the sailings of the grain ships from Sicily.

Past and Future of Mesopotamia and Persia

Mesopotamia was once the most fertile region on earth. Its possession gave the wealth that made the great kings Sargon, Xerxes, Nebuchadnezzar, Darius, Cyrus, and many others down to the Caliph Haroun al Raschid of Baghdad. Its first set back was when Hulagu (a descendant of the terrible Genghis Khan, whose empire was the largest ever known on earth) deliberately put the population of Baghdad to the sword, at the same time that he cut the canals and irrigation system, compelling the people to resume their old nomadic life. Settlers on the land, in his opinion, were very inferior to herdsmen and wanderers. Now the water of the two rivers—Euphrates and Tigris—has fallen so low that there is not enough for both navigation and irrigation. Enormous sums would have to be spent to restore the fertility even if it were possible. The sources of the rivers of Mesopotamia have been deforested, and as they lie in Turkish territories, the present owners could not be expected to co-operate and spend their money and energy for the benefit of another people and another government.

Persia is the next desert country to which we come. One of the oldest empires in the world, it achieved wealth and civilisation many thousands of years ago. It was a conquering power at the dawn of Greek history and a menace to its neighbours. For four centuries it fought the Roman Empire for the rich prize of Mesopotamia, inflicting countless defeats on them, and once capturing a whole Roman army and the Emperor Valerian himself. Why has it decayed? Why has it now such a sparse population where once there were cities such as Persepolis and Susa, nearly as big as London? The curse of drought has fallen on it and it only exists by irrigation.

The Gobi Desert

In the centre of Asia is a group of deserts known generally as the "Gobi," though locally there are many other names. Sven Heydn and Sir Aurel Stein have done much exploration in them. Both report the existence of extensive ruins, temples, shrines, inscriptions, documents, mummies, and dried-up rivers and lakes. The difficulties of travel were so great owing to the absence of water that Sir Aurel Stein was only able to proceed in the winter, in the Lob Nor desert, because he could then load his camels with lumps of ice and by this means could spend a month at a time away from the water supply. He found there a dried up inland river system, leading to a lake bed without an outlet, and now quite deserted. It was the cradle of the Chinese race, from which they were forced by drought.

The true Gobi is supposed to have been the home of the Huns, against whose raids the Chinese, 2,000 years ago, built their famous wall, the largest work of man, which to this day faces the desert for 1,000 miles. In the north of this desert was the city of Karakorum, the capital of the empire of Genghis Khan, whence his armies commanded the whole of Asia, conquered the Crimea, defeated the Poles, and laid the Russian Grand Dukes under tribute. Marco Polo, the Venetian traveller, visited Karakorum in A.D. 1260, but he does not seem to have had any difficulty in crossing the Gobi, which therefore could not have been a desert at that time—that is, if we can trust his veracity.

It would be tedious to go through the whole of the earth's deserts; enough has been brought forward to show the sameness of their history. They have not always been deserts, but have generally at some time supported humanity, in many instances very large and civilised populations. It seems as if there must be some cause, affecting the whole earth, reducing the available quantity of water, and gradually turning the fertile portions into uninhabitable regions. If so, what is the cause? Can it be met and neutralised in any way?

Reduction of the Earth's Water

It is plain that in the making of the earth it received as its share a definite quantity of water, which can

never be added to.[1] But can this quantity be reduced? That is the point, and the answer is that both its total amount and, worse still, its available quantity can be very seriously reduced in several ways.

(1) A glacial period, for instance, would lock up an immense quantity on the tops of the mountains, and reduce the amount available for rains.

(2) By chemical action a great deal of water is withdrawn into vegetation and into the rocks forming the substance of the earth.

(3) It may be broken up into its constituent gases and lost to the earth as water.

(4) Water may sink into the earth farther than it now goes and be out of reach of man and of the sun, which now raises it up into clouds and distributes it as rain.

The most dangerous cause of reduction is the last. It is admitted that the earth was once very hot, spinning in space and surrounded with masses of various vapours as Jupiter now is. As it chilled a crust formed, on which water condensed when it was cool enough. The seas collected in the hollows and, being very hot, evaporated rapidly, causing torrential rainfall which carved the surface into mountain, valley, and plain. None of the water could penetrate the surface, because it was so hot that it was driven out as steam. Thus the whole of the moisture was on the actual surface or in the clouds.

As the earth cooled, water was able to penetrate the surface more and more, following the heated core as closely as the temperature would allow. The whole crust is permeable, though not equally so. All rocks and strata hold water to greater or less degree. It is not possible to sink a deep shaft for a mine without encountering water, as we know to our cost, for it has to be pumped out at great expense. It is common knowledge that, if a mine is not worked, it is soon flooded.

We are thus irresistibly forced to the conclusion that we are in the midst of a gradual progressive drying up of our earth, due to causes almost entirely out of our control, which has already destroyed a great deal of the best parts of the earth's surface and now menaces the rest, and which must sooner or later put an end to our race and all other life on the world.

What of the Future?

Though the world is drying up, mankind can probably delay the process, if the nations will work together to this end. Our nearest planetary neighbour, Mars, is apparently in worse case than we are, having reached a more decrepit stage of stellar existence. There, according to Professors Schiapparelli, Lowell and Pickering, life exists, but it is only made possible by irrigation on a world-wide scale. Whether, when the earth reaches this stage, there will be a struggle for the water sources or not, is a problem that the future only can solve.

[1] N.B.—The products of combustion appear to add water, but really the actions of breathing and fire only cause the return of what has been abstracted by the processes of life.

Reviews of Books

SCIENCE AND PROGRESS

Science and Human Affairs from the Viewpoint of Biology. By Winterton C. Curtis, Ph.D., Professor of Zoology in the University of Missouri. (G. Bell & Sons, 15*s*.)

Progress and Science. Essays in Criticism. By Robert Shafer. (Yale University Press, 12*s*.)

We live in a world to-day which is ruled by the great god Science. Our very thoughts are dissected under its laws; we are born with all the resources of science to expedite us, and die with all the resources of science to delay us; in the years between we are fed with food rushed from the ends of the earth by the scientific control of energy. We are in the very whirlpool of the scientific age—from the day we first listen with amazement to the ticking of an uncle's gold watch to the day when we observe with anxious hope the last doctor's latest instrument. We are face to face with an ever-widening vista of fact and experiment and scientific theory which is bewildering in its variety and utterly beyond our powers to grasp in its entirety.

And at times we ask ourselves certain questions. What is progress, and how does science advance it? What are the great fundamental ideas underlying the scientist's outlook to-day? And, above all, how did all this marvel of science begin, how did men live and think in the far-away years, and what do we inherit from the remote past?

Professor Curtis's book provides us with answers to all these questions. They are the answers of a man to whom science is the all-sufficient motive in life. He does not consider very deeply whither humanity is bound; it suffices for him to know that we are slowly learning what truth is. So the fairies and ghosts—and even, it seems, Michael and all the angels—leave the dark nights which once they haunted or made glad, and the stars and the moon come into their own to provide an alternative magic and poetry. He tells us how it all began—in Greece, where man's unfettered mind first sought for great unifying truths; in Egypt, where mechanical invention came to birth; in Mesopotamia, where men learned to deal with numbers and laid the foundations of mathematics. There came the fall of ancient civilisation and the Dark Ages as a flood to submerge all that had been won of fact and theory and method over three thousand years. Professor Curtis sees in the Middle Ages the crushing power of authority in the form of the Church effectually sub-

duing and controlling the divine curiosity of men. And then, as Professor Curtis views the history of civilisation, there comes the welcome dawn, and the new theories of life—the theory of evolution, the theory of the cell-structure of living creatures—to change the mind of man, and, furthermore, a hundred inventions which altered the face of the earth.

This is a really good book. It fulfils the first essential of a good book—it is interesting. It is well balanced, and gives us a glimpse of a very wide variety of subjects. It preaches the doctrine of " Science for its own sake." All knowledge is useful knowledge. The Dutch microscopist, Leeuwenhoek, who first described little animals in water in which pepper had lain infused, pointed the way to Pasteur and Lister and the germ theory of disease. The author considers that the industrial spirit of to-day is the great enemy of science ; commerce was born of science, and now ungratefully forces research into lines of obviously and immediately useful discovery, rather than into general and impartial efforts to know " how the wheels go round."

It is an interesting and instructive study in the varieties of the human mind to turn to another American book, Mr. R. Shafer's *Progress and Science*. We turned the last page of Professor Curtis's book with a slight feeling of dissatisfaction. We were asked to be so completely contented wtih science. It seemed a rather comfortless prospect. There was so much else besides facts to be reckoned with in the tangle of human life. " Instincts immature," " Purposes unsure," " Fancies that broke through language and escaped," did not seem to fit into his picture. We whispered with Bernard Shaw, " Life's not logical. So much the worse for logic."

And here is a book which has serious doubts about science. Like our English Dean Inge, the author does not believe that our ant-like activities really advance humanity. He is far more dismal than our own optimistic pessimist; his final opinion is that, " We are bound to conclude that there is at present no valid ground for belief that life will ever be easy or pleasant for the vast majority of mankind." We turned from Professor Curtis, regretting our " banshees," and find Mr. Shafer too unhappy even to find relief in them. " Industry has succeeded only through oppression." " The term ' labour-saving device ' is little else than a fool's coinage." Evolution gives no guarantee that an ethically or æsthetically good quality will be evolved. However, although we can gather that he appreciates certain spiritual values of the very religious instinct that to Professor Curtis was anathema, he does not tell us what real progress would be. He quotes Descartes: " We shall be able to find an art, by which, knowing the force and action of fire, water, air, stars, the heavens, and all other objects, as clearly as we know the various trades of our artisans, we may be able to employ them in the same way for their appropriate uses, and make ourselves the masters and possessors of nature. And this will be not solely for the pleasure of enjoying with ease and by ingenious devices all the good things of the world, but principally for the preservation and improvement of human health, which is both the foundation of all other goods and the means of strengthening and quickening the spirit itself." But he cannot find solace even in such a prospect.

For ourselves, we meekly subscribe to Descartes' fine prophecy. We think of Matthew Arnold's " Hymn of Empedocles " :

> " I say, Fear not ! Life still
> Leaves human effort scope,
> But since life teems with ill,
> Nurse no extravagant hope
> Because thou must not dream, thou need'st not then
> despair."

There is no panacea for human happiness. Truth lives at the bottom of a well—there are many wells, and men will till the end of time go seeking her as fancy takes them. Cannot we keep our fairies, even if science teaches us how best to trap them ? What harm can there be if science hastens our journey from well to well, helps us to cram a few more journeys into the short space of our days ? And, even if the one gift of science were relief from pain, would it not by that gift be consummately justified ?

R. J. V. PULVERTAFT.

A SIDELIGHT ON THE NEAR EAST PROBLEM

Greece and the Allies, 1914–1922. By G. F. ABBOTT. (Methuen & Co., Ltd., 7*s.* 6*d.*)

The claim that history may be considered an exact science is now generally accepted ; but the head master who stated that " any good classical scholar could ' get up ' history in a fortnight " still expresses the attitude of a minority. This minority feels that the difficulty of obtaining reliable data confines the scope of the historian to the recording of a more or less inaccurate narrative of purely academic interest. Indeed, the study of contemporary history, in which prejudice and inaccuracy can only be dealt with by a process of cancellation, throws a convincing light on the difficulties of the political scientist or economist who would build theories of early civilisation from a few broken records.

Mr. Abbott's book will be of great value to the discriminating student of contemporary history, since it shows the situation in the Near East not only in an entirely new light, but supplies a wealth of hitherto unpublished information. There is a popular feeling that if it is worth while for someone to suppress information, that information is worth getting, and Mr. Abbott's book loses nothing in attractiveness from the statement in his preface that, owing to the activities of D.O.R.A., " not until now has it been possible for the voice of facts to refute the fables dictated by interest and accepted by credulity." Nevertheless, Mr. Abbott has done more than give us a mere record of facts ; he has penned an indictment first of M. Venizelos, and secondly of the diplomacy of the Entente. The indictment is able and the defence for the Allies would be hard put to it to make out a case. It is a startling record of indecision and blundering. " By shilly-shallying at Athens, Nish, and

Sofia they only lost the confidence of the Greek and Serbs without gaining that of the Bulgars."

The account of the policy of bullying interference with the Greeks is a sharp blow to our national pride. Perhaps this is why we turn with such relief to Mr. Abbott's explanation that it was all France's fault. "France pursues now the plan laid down by Louis XIV, continued by Napoleon, fitfully carried on in the nineteenth century and facilitated by her installation in Syria—the equivalent of the German *Drang nach Osten*: a plan incompatible with the safety of the British Empire in the East." The policy of creating a Greece dependent on France and capable of being used to further French policy in the East has, he holds, been consistent. The reversal of that policy is a sudden change due to finding Greek feeling entirely anti-French. At all events this book throws considerable light on the apparently anti-French policy which the late Government pursued in the Near East. From Mr. Abbott's account it would seem that the French sowed the pro-Greek policy and left us to reap the Turkish whirlwind.

The writer's chief charge against M. Venizelos is one of deliberate misrepresentation of King Constantine's motives and personality. To those accustomed to look upon the king as the serio-comic villain of the piece it is surprising to learn that "in town, mansion, and village huts men's mouths were filled with his praise," that a weeping crowd obstructed the path of the car that bore him from Greece and that wild acclamation greeted his return. But there is a vaguely familiar ring about the indictment of "the Cretan" which is puzzling, since our Press has been as unanimous in praising M. Venizelos as in condemning ex-King Constantine. M. Venizelos is described by our author as a "man of many talents and few principles, ready to employ the most tortuous and unscrupulous methods—sometimes indeed for ends in themselves patriotic but often merely for aggrandising himself."

We have heard something like that before, but it was about one of our own politicians. It is the same controversy about brains and character which is perplexing many of us in England. There is a tendency, doubtless healthy, to grudge "principle" to all but the mentally mediocre; a feeling that not only may a lady be "too pretty to be good," but that a politician may be too clever to be principled. Mr. Abbott tells us of M. Venizelos at the beginning of his career that "the new man did not disappoint the faith placed in him. Through the next two years he stood in every eye as the embodiment of constructive statesmanship. . . . Greece seemed as an invalid, healed and ready to face the future." It is hard to believe that this man is an unscrupulous opportunist. Is it not at least a possibility that M. Venizelos is a genuine and single-minded patriot, and that the troubles of his country are due rather to Allied intrigue than to his own bad judgment or unscrupulous methods? At all events we prefer to reserve judgment until we hear the other side.

Mr. Abbott's book is obviously written with the purpose of vindicating the good name of Greece. We are too near the period which he covers, and we are certainly too near the results of that period, which have involved us in such a perplexing position in the Near East, to pronounce a definite opinion upon the attitude which he has assumed. But this we can say about the book, that it will provide a valuable antidote to the one-sided propaganda of our daily Press since 1915.

E. L. M. C.

Books Received

(Mention in this column does not preclude a review.)

MISCELLANEOUS

Bibliography of English Language and Literature, 1921. Edited for the Modern Humanities Research Association by A. C. PANES. (Bowes & Bowes, Cambridge, 4*s*. 6*d*.)

The Pattern of the "Iliad." By J. T. SHEPPARD, M.A., Litt.D. (Methuen & Co., Ltd., 7*s*. 6*d*.)

Early British Trackways. By ALFRED WATKINS. (Hereford: The Watkins Motor Co.; London: Simpkin, Marshall, Hamilton, Kent & Co., 4*s*. 6*d*.)

Lola, or the Thought and Speech of Animals. By HENRY KINDERMANN. (Methuen & Co., Ltd., 6*s*.)

Greece and the Allies, 1914–1922. By G. F. ABBOTT. With a Preface by ADMIRAL MARK KERR, C.B., M.V.O. (Methuen & Co., Ltd., 7*s*. 6*d*.)

Everyday Life in the New Stone, Bronze, and Early Iron Ages. Written and Illustrated by MARJORIE and C. H. B. QUENNELL. (B. T. Batsford, Ltd., 5*s*.)

Water-Power in the British Empire. The Reports of the Water-Power Committee of the Conjoint Board of Scientific Societies. By SIR DUGALD CLERK, K.B.E., F.R.S., and PROF. A. H. GIBSON, D.Sc., M.Inst.C.E. (Constable & Co., Ltd., 5*s*.)

Readings from the Literature of Ancient Rome. In English Translations. By DORA PYM. (George G. Harrap & Co., Ltd., 3*s*. 6*d*.)

PSYCHOLOGY AND PHILOSOPHY

The Measurement of Emotion. By W. WHATELY SMITH, M.A. With Introduction by WILLIAM BROWN, M.D., D.Sc. (The International Library of Psychology, Philosophy, and Scientific Method: Kegan Paul, Trench, Trübner & Co., Ltd., 10*s*. 6*d*.)

Tractatus Logico-Philosophicus. By L. WITTGENSTEIN. With Introduction by BERTRAND RUSSELL, F.R.S. (The International Library of Psychology, Philosophy, and Scientific Method: Kegan Paul, Trench, Trübner & Co., Ltd., 10*s*. 6*d*.)

Our Unconscious Mind and How to Use It. By FREDERICK PIERCE. (Kegan Paul, Trench, Trübner & Co., Ltd., 10*s*. 6*d*.)

SCIENCE

Pages of Science. Selected and edited by GEORGE SAMPSON. (Methuen & Co., Ltd., 2*s.*)

The Microscope. A practical handbook. By LEWIS WRIGHT. Enlarged and revised by A. H. DREW, D.Sc., F.R.M.S. (Religious Tract Society, 5*s.*)

English Coastal Evolution. By E. M. WARD, M.A. (Methuen & Co., Ltd., 8*s.* 6*d.*)

An informed and interesting account in moderate compass of a somewhat neglected subject. After discussing the problem generally the author describes different parts of the coast in some detail.

Chemistry in the Service of the Community. By ARNOLD ROWSBY TANKARD, F.I.C. (Benn Brothers, 1*s.*)

An article in praise of chemistry by the public analyst and bacteriologist of Hull, dealing shortly with fertilisers, foodstuffs, adulteration of food, chemistry in industry, etc.

History of Chemistry. By FRANCIS P. VENABLE, Ph.D., D.Sc., LL.D. (George G. Harrap & Co., 5*s.*)

An American book, readable and accurate, but containing the barest outline of the subject (for example, one paragraph only on colloids), and consequently suitable only for a first reading.

Crystal Receivers for Broadcast Reception. By P. W. HARRIS. (1*s.* 6*d.*)

The Wireless Telephone: What it is and How it Works. By P. R. COURSEY, B.Sc. (2*s.* 6*d.*)

Masts and Aerial Construction for Amateurs. By F. J. AINSLEY, A.M.I.C.E. (1*s.* 6*d.*)

The Perry Auto-Time Morse System. By F. W. PERRY. (6*d.*)

(All published by the Wireless Press, Ltd.)

Books for "wireless amateurs," simply and carefully written and well illustrated.

Direction and Position Finding by Wireless. By R. KEEN, B.Eng., A.M.I.E.E. (The Wireless Press, Ltd., 9*s.*)

A monograph for the serious student, dealing not only with the principles of the subject, but also with such practical matters as constructional details, the use of maps, freak phenomena, the mastering of difficulties, and the elimination of faults. It should be of real use to an engineer studying this department of wireless work for the first time.

Wireless Popular and Concise. By LT.-COL. C. G. CHETWODE CRAWLEY, R.M.A., M.I.E.E. (Hutchinson & Co., 1*s.* 6*d.*)

The elements of the subjects put clearly by an authority. Portions of the book have already appeared in DISCOVERY as articles. A good introduction to the subject.

The Meaning of Relativity. By ALBERT EINSTEIN. Translated by PROF. E. P. ADAMS, Princeton University. (Methuen & Co., Ltd., 5*s.*)

Four lectures delivered at Princeton University in May 1921, on Space and Time in Pre-Relativity Physics, the Theory of Special Relativity, and the General Theory of Relativity. For advanced physicists and mathematicians.

Correspondence

ENGLISH PLACE-NAMES

To the Editor of DISCOVERY

SIR,

I am so strongly in sympathy with the view that the co-operation of topographers is essential if place-name studies are to be put upon a sure basis that to prevent misunderstanding I had better, perhaps, define my own attitude toward the matter, which is also that of those who are responsible for the Survey of English Place-names. It is that no explanation of a place-name based upon a study of its old forms should be offered if it is inconsistent with the known topographical facts. If, however, the co-operation is to be a full and just one, it is equally important to recognise the converse of that proposition, viz. that no explanation of a name based upon topographical considerations alone can be accepted if it is inconsistent with the early forms of the name. I ventured to criticise Mr. Watkins's views only so far as they seemed not to fulfil this second condition of place-name interpretation.

Yours, etc.,
ALLEN MAWER.

DIRECTOR,
SURVEY OF ENGLISH PLACE-NAMES,
THE UNIVERSITY, LIVERPOOL.
November 6, 1922.

[This letter from Professor Mawer is a reply to a letter by Mr. Alfred Watkins which appeared in the last number of DISCOVERY.—ED.]

Continued from page 8.]

that the discovery amongst other objects consists of "the funeral paraphernalia of the Egyptian King Tutankhamen, one of the famous heretic Kings of the 18th dynasty, who reverted to Amen worship. Little is known of the later Kings, including Tutankhamen, and the discovery should add invaluably to our knowledge of this period and of the great city of Tel el Amarna, which was founded in the fifteenth century B.C., by Amenhotep IV, the first of the heretic Kings."

No such quantity of furniture and provisions of the most valuable kind, dating back to about 3,500 years, has ever before been found intact. We hope to publish an account of the excavations in an early subsequent number. Meanwhile, we can only say that it is a strange coincidence that it occurred in 1922, a year which may be justly regarded as the Centenary of Egyptology, for in 1822 a young Frenchman, Champollion, discovered a definite clue to the interpretation of Ancient Egyptian Hieroglyphics on the famous Rosetta stone, as the result of which the study of Egyptology grew apace.

CONFERENCE IN CLASSICAL ARCHÆOLOGY

A CONFERENCE in Classical Archæology will be held at Oxford, with the sanction of the Committee for Classical Archæology, in the Ashmolean Museum (by permission of the Visitors) from January 9 to 16, 1923. Lectures, discussions, and demonstrations will be held concerning Greek and Roman monuments and antiquities. The fee for membership will be £1. Applications for membership are received by the Hon. Secretary, Mr. Stanley Casson, New College, Oxford. The Conference is intended, in the first instance, for those engaged in teaching. A programme of the conference and general information as to accommodation will be issued later.